PC MAGAZINE

FREE
HARD DISK
ANALYZER UTILITY

*You Can't Go Wrong
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…or Can You?

The AT Hard Disk Failures

Replacing Your AT Hard Disk

IBM & CMI Respond

Users & Dealers Speak Out

■ Two New AT
Alternatives

■ How Okidata Fixed
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Word processing, spreadsheets, and more.

PC MAGAZINE

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FEATURES

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WHAT'S INSIDE

When IBM introduced the PC AT nearly 2 years ago, we were surprised and impressed. The AT was a real breakthrough, which was unusual for IBM, a company better known for its savvy marketing and outstanding service than for product innovation. While the competition was busy making slightly faster PC clones, IBM's new AT came equipped with a fast (6 MHz was fast back then), advanced-technology Intel 80286 processor, high-performance 20-megabyte hard disks, and 1.2-megabyte/360K-byte floppy disks. It could even run Microsoft's multiuser UNIX version, XENIX. What more could an office full of PC-dependent overachievers possibly want?

A reliable computer, that's what. When early reports of AT hard disk failures landed in our mailbox, it looked like the normal "ramping up" problems any company faces with a new machine. IBM encouraged this view by insisting that the AT hard disk failure rate was well within normal limits, which was reassuring from the company that virtually invented quality control. As reports of AT disk failures persisted and grew, however, we became concerned. When trouble struck on *PC Magazine's* home turf, we became more concerned, and when the trouble and IBM's rosy assurances persisted, we became alarmed and decided to take a much closer look at the reliability of the AT and its hard disk.

The AT's problems have users and dealers from coast to coast courting disaster, and in this issue *PC Magazine* covers all the angles. Read our horror stories, get the dealer perspective, hear out IBM, and check out the alternatives we describe. It all begins on page 106.

Also in this issue, Charles Petzold presents DISKSCAN, a much-needed utility program that routinely monitors your disks and reports on the problems it finds (page 241). On page 203, Carol Day explains your options when things go wrong and your PC needs serious repair.

Dara Pearlman, Diane Burns, and Sharyn Venit review mail-mergers in nine popular word processing programs (see page 165). Though often cumbersome, these important word processing tools are much more powerful than you might expect. Speaking of cumbersome, you may remember how poorly Okidata's new Microline printers fared in last year's printer issue. Okidata heard our complaints and made substantial improvements to the printers, which have therefore earned a second look (page 147).

It's easy to be hard on IBM because we expect so much from its products. But it's tough, too, because, despite their problems, we're not about to toss our ATs out the window. Executive editor Paul Somerson explains why in "How Much Is That Logo in the Corner?" on page 109. □

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XVI

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LETTERS TO PC MAGAZINE

WORD OF MOUTH

WordPerfect is! Your comprehensive (Herculean, I might add) special issue on word processors ("The Business of Words," *PC Magazine*, Volume 5 Number 5) was both timely and well done. As a former corporate and legal word processor, currently a book writer and president of a corporate word processing training

company, I have great admiration for both the editorial management and astute analysis by your reviewers, which shows from conception through to detailed execution in the special issue.

But, in my opinion, *WordPerfect 4.1* should have been included in the corporate list as a legitimate contender for top honors in the corporate as well as professional category. It's a true crossover ("perfect" as your reviewer said) program.

Kenneth R. Kappel
New York, New York

I appreciate your recent review of our word processing program *Allegory* ("The Business of Words"), since it confirms our pride in *Allegory.*

There was one glaring problem, however. The editing screen pictured in the Expanded Fact File (page 103) conveys a misleading impression of what *Allegory* is all about. In the screen, *Allegory* appears

to handle text on a line-by-line basis without automatic up-to-the-moment formatting. What happened was that when the reviewer exported his original *Allegory* document to an ASCII file, that file was reimported into *Allegory* by *PC Magazine* for photographing. When using all but the simplest word processor, this procedure results in the unavoidable loss of some original formatting information, since standard ASCII doesn't provide for all word processing information.

The format line remains as it was set during the importation process, not as it would be for working with the document, and tabs were unnecessarily replaced by spaces.

By the way, our new address is as follows: April Software Inc., 6728 Fair Oaks Blvd., #403, Carmichael, CA 95608.

Scott Brownlie
April Software
Carmichael, California

WORDS UNDERGROUND

You had an intriguing article in your January 28 issue entitled "Handy with a Wrench? Try Do-It-Yourself WordStar" (*PC Magazine*, Volume 5 Number 2), a review by Ward Starr and Mel Murch.

Unfortunately, I could find no mention of the publisher or any suggestion as to where I might be able to purchase their book.

Ronald J. Pierce
Bellingham, Washington

There's only one source for Underground WordStar—*directly from Ward and Mel themselves. This cult classic book/disk package on customizing every last feature of* WordStar *and uncovering its undocumented features goes for a mere $19.95*

plus $2 for first-class postage. Write Hard/Soft Press, Box 1277R, Riverdale, NY 10471.—Ed.

PC INTELLIGENCE ARTIFICIAL?

In Jeffrey Rothfeder's article, "Is There Intelligent Life in the PC?" (*PC Magazine*, Volume 5 Number 1), he describes using the query "What do you think about war?" in *Logic-Line Series 1.* The program retrieves the quote "I hope it will not be thought disrespectful to those gentlemen if, entertaining as I do opinions of a character very opposite theirs, I shall speak forth my sentiments freely and without reserve," and then he claims this extract has a "more abstract connection" to the query. What connection? Is there any query whatsoever to which this extract could not be understood to have such a connection? How could one tell if an extract actually had no such abstract connection? If such apparent non-sequiturs can be considered to have a connection with the query, how would one tell if the program was working properly?

If the program could actually do anything more than find actual word occurrences, certainly it should be able to find near or exact synonyms, such as *freedom* and *liberty.*

When we tried a straight word search in *Logic-Line* using the word *freedom,* it found no references to *liberty.* When we did a straight search using the word *liberty,* it found no references to *freedom.* A straight word search on the word *codfish,*

■ LETTERS

by the way, came up with several passages of extracted text, none of which contained the word.

The second file in the manual (which by the way is very bad) contains the word *freedom*, but if you replace that file with one containing the word *liberty*, remarkably, you obtain the exact same results. The program works! But wait a minute—what happens when you replace that second file with one containing the word *codfish*? Again, the exact same results. How about a null file, containing only the required delimiter? No surprise, the exact same results.

Peter Kassan,
Paul Goldenberg,
and David Wolk
Brooklyn, New York

Jeffrey Rothfeder was right on target in "Is There Intelligent Life in the PC?" It's unfortunate that so many reporters have swallowed press releases infected with "artificial intelligence" hype. I might believe artificial intelligence is in the realm of possibility if a computer can be designed and programmed to drive me from La Guardia Airport to midtown Manhattan during rush hour, entertain me with stories about New York City, make change for the fare, and recommend a good restaurant.

Forrest M. Mims, III
Seguin, Texas

Jeffrey Rothfeder replies:
I don't disagree with the gentlemen from Brooklyn about Logic-Line Series 1, but they're taking my comments out of context. The Patrick Henry statement is connected to the query only because the program, as I mention in the article, provides two responses. One is: "The war is inevitable—let it come! I repeat it, sir, let it come." The second statement, quoted above, is important because it indicates in an abstract, nonliteral way that while many in the group may oppose war, he does not. It's not a non sequitur but a further explanation of Patrick Henry's position. Forefathers aside, I agree Logic-Line leaves much to be desired. Artificial intelligence doesn't yet exist on the PC, and if a program—even one that promises more—seems less smart to them, that's because it is.

■ LETTERS

THE MOUSE THAT ROARED
In the article "Operating in a New Environment" (*PC Magazine*, Volume 5 Number 4), the Microsoft Mouse is referred to as "the most popular mouse for the IBM PC" and in "Building a Better Mouse Interface" (in the same issue) as "a de facto standard."

It is pretty widely accepted that there are two mice for the IBM PC and compatibles that have established themselves in

> ■ Designing a mechanical mouse involves frustrating trade-offs between accuracy and the need for periodic cleaning and between mouse life and cost.

the marketplace: the other one is Mouse Systems's PC Mouse. This acceptance is reflected in the fact that software developers, including Microsoft itself, uniformly support both.

It's noteworthy that there are differences in optical and mechanical mouse technology. Designing a mechanical mouse involves frustrating trade-offs between accuracy and the need for periodic cleaning and between mouse life and cost. Despite the efforts of mechanical mouse manufacturers to minimize these shortcomings, many users in search of a clean surface with consistent friction are buying mouse pads.

The optical mouse, which is the kind we make, is only part of the trend toward the use of optical and electronic technology in applications as diverse as supermarket scanners and high-fidelity recordings. Just as compact disk recording is inherently superior to a conventional record in fidelity and life, the optical mouse has fundamental advantages over the mechanical mouse in its design. Rather than depending on the accurate rotation of a steel ball roll-

ing across a surface, the movement of an optical mouse is measured digitally, relative to a grid printed on its pad. Since no moving parts are involved, the optical mouse moves smoothly and noiselessly, requires no cleaning, and has a much longer life.

> Robert V. Dickinson
> President, Mouse Systems
> Santa Clara, California

FAN OF THE BEST
The January 14 issue of *PC Magazine* (Volume 5 Number 1) was one of the best ever! "The Best of 1985 (and Some of the Worst)" was fascinating reading, and the two in-depth articles on memory and copy-protection systems were well-done pieces on the right subjects.

> Joseph Williams
> Brussels, Belgium

CORRECTIONS
In "Demo Programs Simulate Software, Aid Teaching" (*PC Magazine*, Volume 5 Number 3, page 46), Software Recording's *AutoMentor* was listed as costing $2,500, including a recorder, a run-time version, and 100 run-time modules. The recorder alone costs $895, and players to run that tape cost $100 each.

In "The Copy Protection Wars" (Volume 5 Number 1) Ashton-Tate's *Framework* and *dBASE III* are listed as using the "key disk" method of copy protection. Only *Version 1.0* of both products used that technique. Ashton-Tate now uses the *Softguard* system, which allows for hard disk installation.

HOW TO WRITE TO PC MAGAZINE
Do you have a comment, compliment, or criticism about something you've read in *PC Magazine?* A question you'd like to open up to other readers? Then send your opinion on paper or diskette to Letters to *PC Magazine, PC Magazine,* One Park Ave., New York, NY 10016, or send your opinion through MCI Mail to PCMAGAZINE at address 157-9301. We're sorry we're not able to answer letters personally. All letters become the property of *PC Magazine* and may be subject to editing. We can't print letters that do not include a name, address, and phone number for verification.

Imagine him at 70 MPH.

If the pace of your PC is driving you buggy, read on. Because now you can make it function up to 700% faster with the *SpeedPac 286*™. So what once took eons for your IBM PC or PC/XT, now happens in a flash. Often faster than an AT. And for a lot less than you might think—just $595. And you don't have to add memory, or worry about software compatibility. What's more (or less), our 80286-generation accelerator is a half-slot board, which saves room for other add-on cards. And installing it is so easy it's virtually goof-proof. But then so is buying it—you get a 60-day Money-Back Guarantee. Call June at 1-800-248-5252 for more information, your nearest VICTOR dealer, or to order your *SpeedPac 286*. It'll turn your sluggish PC into a whole different animal. So why wait any longer?

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CIRCLE 136 ON READER SERVICE CARD

■ EDITED BY GUS VENDITTO

PC ADVISOR

The PC Advisor helps readers choose the hardware and software products that are best suited to their specific needs.

AN EXPANDING DATABASE

I've set up a database with PFS: FILE and am frustrated by its inability to handle new formats. I want to change the way some of our files are stored; I have three people who enter records daily.

Mike Ullheim
Paramus, New Jersey

Database software choices abound because the needs of individuals vary so widely. PFS: FILE is one of the easiest to learn and get up and running, but it doesn't handle complex data relationships well.

Power-Base is probably the best product for you (PowerBase Systems, Birmingham, MI 34010; (313) 540-0900; $349). It imports PFS: FILE databases smoothly, so you'll have minimal difficulty in using the old data.

Q&A (Symantec Corp., Cupertino, CA 95014; (408) 253-9600; $299) has a command structure that's very similar to PFS's, and it could be just enough of a step up the ladder if you've invested much time in employee training (see "Q&A: A Database with a Smart Interface," PC Magazine, Volume 5 Number 5, for a full description of Q&A's features).

Two of the most powerful products on the market are dBASE III (Ashton-Tate, Culver City, CA 90230; $700) and RBase 5000 (Microrim, Bellevue, WA 98007; (206) 641-6619; $700). They'll require more effort from you far learning and setting up your new database, but they could pay off in the flexibility you'll have in managing your data and creating easy-to-use

data-entry systems—if you're willing to take the time to master them.

If you have more-specific requirements that you didn't share here, wait a few more weeks. PC Magazine Labs will be reviewing a wide range of the latest database managers. We'll look into the most important products and let you know their strengths and weaknesses.

EXPANDING WHEN THE EXPANSION SLOTS ARE ALL TAKEN

I have a Panasonic Sr. Partner with two floppy disk drives. I have been thinking about adding a hard disk drive. But the Sr. Partner comes with only two expansion slots, which are currently occupied by a memory-expansion board and a Ven-Tel Half-Card 1200-bit-per-second modem. I guess I could solve my space problem by removing the modem board and replacing it with a hard disk controller, but I need my modem board too.

Jacob D. Lee
Granada Hills, California

Sounds like you've outgrown your computer—a common complaint. Before you spend any more money upgrading your system, it would be wise to stop and consider your needs beyond the near future and into the next few years. After all, if you had planned for the future, you probably wouldn't have acquired an internal modem since you have a shortage of slots in your Sr. Partner; it would have been more prudent to buy an external modem that needed only one of the two ports you have.

It might be more cost-effective for you

to upgrade to an IBM AT, XT, or compatible that offers the features you need.

Did you buy your Sr. Partner for its portability? Adding an external hard disk will take that away from you. Maybe you need to have a hard-disk-equipped XT or compatible as a base system, while you use your Sr. Partner away from home.

If you decide that a hard disk and a few expansion cards will satisfy you, an expansion chassis can give your Sr. Partner the options you need. Everex (Mountain View, CA 94043; (800) 821-0806) has three models that retail for $499: the Slim Line (with two half-height and three full-size slots), the Full-Size (with room for a full-size drive and expansion slots), and the Half-Size (with room for two half-height drives and expansion slots). PC Horizons (Santa Ana, CA 92705; (714) 953-5396; $549) offers the PC-Xtra (with five full-size and one three-quarter slot). Panasonic's model RD9655 expansion box comes with three slots (Secaucus, NJ 07094; (800) 742-8086; $399.95).

Using one of these chassis, you would move one of your cards from your computer into the expansion unit once it's hooked up; you'll then have room for a hard disk, a hard disk card, a Bernoulli Box, or just about any other addition that requires a slot.

ASK THE ADVISOR

Send your questions about hardware and software choices you are facing to The PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016. Or write via MCI Mail to G. Venditto.

PRINTERS'

For what you used to pay for a 9-pin printer

When you see our new Pinwriter™ P6, P7 series dot matrix printers, you'll think you're in a time warp.

These are the first 24-pin printers that list for as little as $699. Or about what you would have paid for an ordinary 9-pin printer a year ago.

Now, that's progress. Especially when you consider our new printers have an advanced 24-pin printhead. And print data at 216 characters per second and crisp, dense letter-quality at up to 65 cps. Which is as fast as most 9-pin printers turn out data quality.

Actually these new Pinwriter dot matrix printers surpass every other printer in their price range. In their combination of speed, graphics resolution, the number of built-in fonts and low noise level.

None of which will surprise you if you know NEC printers. Because nobody does more with 24-pin technology than NEC. In fact, we now have more 24-pin printer models than any other manufacturer.

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PROGRESS.

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now, you can buy
our fully-featured
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So if you're looking for a printer that will do more and do it better, just progress to your NEC dealer and you'll get it for less than you imagined.

If you would like more details about our full line of 24-pin Pinwriter printers, call 1-800-343-4418 (in MA 617-264-8635). Or write: NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.

NEC PRINTERS. THEY ONLY STOP WHEN YOU WANT THEM TO.

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PC MAGAZINE NEWS

300-Megabyte Hard Disks Now in the Works for PCs

New internal drives will equal or exceed storage capacity of many minicomputers.

BY WINN L. ROSCH
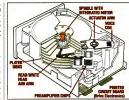
The next generation of internal PC hard disks will make today's 20- and 30-megabyte drives seem as tiny and slow as floppies. Internal drives are now available in 190-megabyte capacity; 310-megabyte (unformatted) disks are due in a matter of months. New peripheral interfaces are breaking the 5-MHz data-transfer-rate barrier, and higher-performance head actuators are cutting disk-access times—once a leisurely 100 milliseconds—to under 20, that is, from $1/10$ second to $1/50$.

IBM first made PC hard disks available in March 1983, with the $4,995 PC-XT. Its 10-megabyte hard disk had an 85- to 100-millisecond access time and accounted for about $2,000 of the cost. The PC AT advanced the standard to 20 megabytes and a 40-millisecond disk-access time in August 1984; the disk cost $1,595. In November 1985, IBM added a 30-megabyte PC AT option for $1,995. If the IBM logo isn't crucial, 10- and 20-megabyte disks of various pedigrees are available today for under $500; budget AT-speed 20- and 30-megabyte disks can be had for $750.

Maxtor Corp. of San Jose, Calif., produces the 190-mega-

byte (about 140 megabytes formatted) hard disk for several third-party suppliers. Core International of Boca Raton, Fla., is readying the 310-megabyte HC25 (about 250 megabytes formatted), which will sell for $8,995.

Fast Disks for Fast PCs

The impetus for these fundamental changes in hard disk design lies in an increasing emphasis on high-performance desktop computing for network, multiuser, and data-intensive systems. Computer-Aided Design (CAD), engineering, scientific, and database applications require huge data-storage capacities and high speeds for access to that mass of data

(continued on next page)

SPINDLE WITH INTEGRATED MOTOR
ACTUATOR ARM
VOICE COIL
PLATER
READ/WRITE HEAD AND ARM
PREAMPLIFIER CHIPS
PRINTED CIRCUIT BOARD (Drive Electronics)

Massive hard disks that fit inside a PC help blur the line between the personal computer and minicomputer. The cutaway, above, shows a 190-megabyte Maxtor 5¼-inch hard disk, with eight platters (the hard disks have two platters). Core International plans to release a 310-megabyte, $8,995 internal disk later this year.

Laptops Gain Added Utility

New technologies improve screen displays and allow for hard disks.

BY CHARLES BERMANT AND CHRISTOPHER JOHNSTON

Rather than wait for IBM to set the market standard, competitors are refining the laptop/portable category themselves. The results fall midway between 5-pound laptop notebook computers (Tandy Model 100) and 25-pound fully-PC-compatible luggables (Compaq). Currently, Zenith, Quadram, Morrow, and GRID are among those adding new power to the in-between machines.

Quadram has announced a 20-megabyte drive in addition to two higher-contrast screen options; Morrow brought out a 10-mega-byte drive and screen

improvements; and GRID and Hewlett-Packard updated their screen displays. Most have 10-inch diagonal screens with 25 by 80 displays.

(continued on next page)

Zenith's Z-171 will be standard issue for IRS auditors working in the field. The IRS paid about $1,444 each for the 512K-byte Morrow-designed machines.

Hard Disks

(continued from preceding page)

Moreover, the big, fast disks are pushing today's powerful personal computers into competition with minicomputers, comments Hal Prewitt, president of Core International. "With the next generation of hard disks, you can put half a gigabyte [500 megabytes] into an AT and get all the performance you could only get before on a $100,000 computer system," he says.

According to John Klonick of Maxtor Corp. three factors are working together to pack more megabytes into the 5¼-inch hard disks that fit in PCs: more platters, new media, and high-performance head actuators.

Eight Platters

Disk makers are stuffing more disk platters (the rotating elements upon which data are actually stored) into their drive units, adding area for storing data. Maxtor has squeezed eight platters inside a single 5¼-inch drive by putting the motor that spins them inside the spindle on which they are stacked. Even manufacturers relying on more traditional flat "pancake" motors now shoehorn seven platters into the same space. In comparison, the 10- and 20-megabyte disks of the XT and AT have two platters; the 30-megabyte AT has three.

New thin-film plated or sputtered metallic media allow data to be packed ever more tightly in the limited space available in the standard drive slot. Not only do thin-film platters hold more information, but also their tougher, pure-metal surfaces are less prone to head crashes and other physical damage.

As information is packed more tightly onto the platters, more precise mechanisms are required to access it. High-performance closed-servo voice-coil head actuators are replacing traditional band-stepper designs, a technology carried over from floppy disks into the first generation of PC hard disks.

Servo-voice coil actuators quicken track (and data) access as well as help boost capacity.

That's good because bigger disks mean more data to move around and a need to move it faster. Despite the new actuators, however, disk systems remain bound by the 5-MHz data-transfer rate imposed by the standard hard disk interface known as the ST506/412. Although 5 MHz is too fast for PCs and XTs to handle disk data, ATs and RTs can manage it.

ESDI vs. SCSI

Two new interfaces are preeminent in the next generation of hard disks: the Enhanced Small Device Interface (ESDI) and the Small Computer Systems Interface (or SCSI, pronounced "scussy" or "scuzzy").

ESDI allows data-transfer speeds beyond 20 MHz, although the first drives to use the interface operate around 10 MHz. The first pair ESDI systems designed for ATs, the HC series from Core International, will be available soon.

SCSI has already been adopted by Apple as the expansion outlet for the updated Macintosh computer. PC makers, too, are eyeing its high speed—it's designed to shift data at 12 MHz, more than twice as fast as the ST506. AST Research makes a $37,499 74-megabyte SCSI drive, initially named the Colossus, now called the AST-4000.

ESDI and SCSI operate at different levels in the system and can be used together, but, according to industry insiders, the combination is not favorable and leads to its own speed penalties.

This new generation in hard disks just continues the same trend that has always been the theme in disk design—increasing capacity and performance. New big, fast drives are no fad, and the trend will continue, according to Sygsen Inc.'s Richard T. Newsome. "I don't think high-capacity drives will be a flash in the pan like HardCard-style drives," he notes. "People have an insatiable desire for more storage. If there is an empty space on your hard disk, you will find a way to fill it."

Laptops

(continued from preceding page)

Zenith Gets IRS Award

In late February, Zenith won a $27 million contract to provide 15,000 Z-171s to the Internal Revenue Service. The machines, which look like oversize lunchboxes with fold-down keyboards, were designed by Morrow Designs, which produces the same machine as the Morrow Pivot. The Morrow/Zenith unit was the hardware component of IRS bids by both Zenith and Sperry. (IBM's not-yet-announced laptop was another of the half-dozen final bidders.)

The IRS-Zenith lease-purchase contract calls for 15,000 to 18,000 Z-171s equipped with 512K bytes of RAM (upgradable to 640K), a 300/1,200 bit-per-second internal modem, a graphics card, a 4-hour battery pack, and a carrying case. They'll cost the IRS $1,444 each ($40.12 per month for 36 months); the configuration lists for $3,244.

The contract also includes external video displays, Epson thermal and Citizen letter-quality printers, software, and support. The software is Micro-

Quadram's Datavue 25 is available with a 20-megabyte hard disk and a 3½-inch, 768K floppy drive.

soft's MS-DOS, BASIC, and Pascal; the Software Group's *Enable* ($699) integrated package; Microrim's *R:base 5000* ($700) database; and Polytron's *PolyWindows* ($49.95). Lotus Development's *1-2-3* or *Symphony* was conspicuously absent from the winner's circle; one source said copy protection and higher prices worked against Lotus.

Quadram Hard Disk

Quadram of Norcross, Ga., recently added several options to its year-old Datavue 25 portable: a 20-megabyte hard disk and 3½-inch floppy drives, a grayish-white fluorescent backlit screen, and a high-contrast

■ NEWS IN BRIEF

Intel Corp. of Santa Clara, Calif., has unveiled a 10-MHz 80287 coprocessor that does floating-point calculations at more than double the speed of older versions. PC AT owners can't benefit from the increase, however, without a daughterboard or other adaptation. Accelerator board and compatible manufacturers will find it of use in new version of their products. For IBM owners, the 10-MHz 80287's future seems to lie next to the 80386 chip in future machines. Intel is shipping immediately in quantities of 100 for $350.

Remember Vizi On, announced around the same time as Microsoft Windows? It's back as the $150 Control Data Corp. Vizi On Applications Manager, Version 2.4, providing a somewhat Windows-like environment for other members of the Vizi On family (Chart, File, Plan, Word, and Presentation). It also allows installation of other DOS programs and a link to CDC mainframes. Vizi On requires 512K bytes of RAM and a graphics monitor but doesn't support color, the EGA card or multitasking, rendering its comparison to

amber-colored "gaslight" screen.

Quadram is also considering releasing the Datavue 25 with a detachable remote infrared keyboard that would be an under-3-pound electronic notepad computer in itself, containing an 8-line, 80-character flip-up screen and memory. It would be available separately for under $300 as the Keystyle 80.

With one 5¼-inch floppy drive and 256K bytes of RAM, the Datavue 25 sells for $1,695 with the LCD screen, $1,995 with the fluorescent screen, and $2,145 with the gaslight screen. The version with dual 3½-inch drives is $100 more. The 256K Datavue 25 with a hard disk drive with a self-parking head and a 3½-inch floppy costs $3,495.

The Morrow Pivot (a twin to the Zenith) has recently been upgraded with a 10-megabyte hard drive and an improved screen. The price for a 320K-byte unit with a floppy drive and the hard disk is $3,115. (Zenith said a hard disk version of the Z-171 is a distinct possibility.) Morrow says it weighs about 15 pounds. With two floppies, it's $1,895, markedly cheaper than is the Zenith twin.

Morrow president Barry K. Bergholm says 3½-inch disks are a detriment to IBM compatibility. "Most people will use laptops to communicate," he says. "And it's very hard to upload and download from those smaller drives."

Morrow's future is clouded, however, since the company announced that it filed for bankruptcy on March 10.

Improved GRID screen

GRID of Mountain View, Calif., and Hewlett-Packard of Cupertino, Calif., each updated laptop machines shortly after the IRS bid was announced. GRID is now offering a yellow screen display with blue text characters on its 12-pound Gridcase 2 at $3,150 with a 3½-inch floppy and 512K bytes of RAM.

GRID says the new LCD display roughly doubles the contrast from the previous Gridcase 2, to about 7 to 1, which GRID says is the best in the industry. GRID will continue with its $4,350 Gridcase 3, which has a plasma screen.

HP's Portable PLUS is available with an improved LCD and increased memory/communications capabilities, the company says. The HP machine has no disk drives.

CHRISTOPHER JOHNSTON

Microsoft Windows largely pointless.

Borland International has announced its Turbo Prolog compiler, which, the company says, is faster than other Prolog language tools "by factors up to 10,000." The $99.95 program will be used in developing microcomputer-based artificial intelligence tools. The Scotts Valley, Calif., company plans shipment by May.

Zenith Data Systems won a $300 million Defense Department contract to supply 90,000 microcomputers over the next 3 years. Including the recent award to supply the IRS with Z-171 portables, Zenith has been the winner of four out of five major government personal computer contracts. Federal Data Corp. won one competition for transportables. The award for Zenith's 80286-based Z-248 system locks IBM PCs out of the Air Force and Navy and limits sales to the Army for the next 3 years. Prior to its 1983 contract for Z-100s, which grew to nearly 40,000 machines, Zenith had no federal business.

Hard Disk Cards Flood the Market

BY CHARLES BERMANT

Winchester drives on expansion cards have become the fastest-growing category of PC hardware: about a dozen products became available within the 6 months after the first one hit the market.

Costs are falling and capacities are rising, typically from 10 to 20 megabytes. Western Digital Corp. of Irvine, Calif., and Plus Development Corp. of Milpitas, Calif., cut prices of their 10-megabyte cards by $200, to $895 and $995, respectively. By year's end, $600 could be an average price.

Mountain Computer of Scott's Valley, Calif., has introduced a 30-megabyte, 78-millisecond access-time version of its DriveCard for $1,449. While the price seems stiff, Mountain contends the price-per-megabyte—$48—is competitive with lower-capacity disks.

The More the Merrier

PC Magazine has already examined many of the available products in "Hard Disk Cards: An Expensive Solution Worth Considering" (Volume 5 Number 6). Several others have been released since then.

Systems Peripherals Consultants of San Diego is offering its 22-megabyte Scorecard for $895. The drive is detachable from the controller card and can be mounted anywhere in the machine. The Scorecard drive is not covered with plastic or metal, unlike other products.

CMS Inc. of Santa Ana, Calif., offers three hard-disk-

card models, a $795 SCSI (Small Computer Systems Interface) version, a standard $595 model, and an extra-rugged $695 model, in which the heads never touch the drive when not in use. All are 20 megabytes. Each drive takes up a slot and a half.

No Motherboard Power

Microscience of Mountain View, Calif., manufactures the 20-megabyte, $1,095 Easy-Card, which requires that the disk drive power cable be rerouted. The card then draws no power from the motherboard. The card and drive can be separated to facilitate repair.

OnBoard, from Maynard Electronics in Casselberry, Fla., comes in $975, 10-megabyte and $1,195, 20-megabyte configurations. When placed in the slot next to the PC's speaker, it takes up only one slot.

CompuAdd, an Austin, Tex., mail-order and retail firm, is selling the 20-megabyte FlashCard for $595. While it does take a slot and a half, the company offers a half-slot floppy controller for $20, freeing up another slot. Automatic installation software is also included.

Express Systems, a Schaumburg, Ill., mail-order firm, has introduced the $595, 20-megabyte Hard Disk Card, trademarking a name that some thought would become a generic characterization. Needing a slot and a half for operation, it is available with a 60-millisecond access time, a retractable head ($50 extra), and software that allows it and any other installed hard disk to operate as one logical volume ($95).

Mountain Computer's 30-megabyte DriveCard tops its competition in price ($1,449) and capacity—about $48 per megabyte

AND GETTING THEM TO YOU AT REDUCED PRICES, FAST. TRY US!

C-TREE
B-Tree File Manager, Source Code, No Royalties!

C-tree™ has been around since 1979. Ct became Digital Research's Access Manager™. That means seasoned, sturdy code which hasn't cracked under the weight of prolonged and widespread use. C-tree comes in C source code, reveal-

ing all you've ever wanted to know about how b-trees are written. Provided you bend it into your binary application, you can re-distribute C-tree without royalties.

C-tree's design uses nodes to allow any number of users to access an index file simultaneously even during updates. So multi-user configurations and adaptation to networks are possible. You must write record-locking routines, as they are complete and operating system dependent, but the documentation shows how.

The latest version has new features: support of variable record length files, multiple key indexes in a single physical file.

Thanks to source code which does not deviate from the K&R standard, C-tree can travel. Tests in many environments prove that C-tree gives your application a ticket to anywhere.

C-tree permits any number of keys for a data file, supports duplicate keys, alpha-numeric or numeric, etc., etc. — it's a comprehensive product with everything you'd expect. Intelligently designed, too, computing both high level ISAM routines which maintain coding by handling all details of an activity, and low level decomposed step-by-step functions you can access directly. Either way C-tree maintains optimal index structures which will find a record amongst a million key-byte keys in no more than five disk seeks.

Ask for: PC#80   PC Brand: List: $395 $329

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Even after using program disks, you may return any product in this space not coded "•" within 30 days for full refund of purchase price provided it is in our judgment in resaleable condition.

ESSENTIAL C
UTILITY LIBRARY
300 Functions, 50¢ Each

Nothing pays you back quicker than function libraries, for our money the treasure of the C language.

Essential's huge package has 49 functions for screen movement, character manipulation, color display, and screen save and restore, 49 graphics functions to draw lines, shapes and color fill, 18 to reweck strings in novel ways, 22 to set and obtain the default drive and file date/time stamps, plus more across and remove directories and files, 22 for time and date validation, formatting, and elapsed time comparison; 30 to allocate and free memory and execute other programs from within the current program, 24 to capture and control keyboard input, 18 to drive printers, others for communications, sound, and, and . . .

They are 95% in C with those accessing DOS and BIOS (used by many of the C functions) in Assembler. Everything is supplied as libraries and as documented source; so even for C savants, there's much to be learned rummaging about Demos show a sampling of what these procedures can be combined to do, and the manual clearly presents and describes all functions.

Lattice LC300 / MS Wine <   List: $185
LCO01 / C86 LC300 /
DeSmet LC303   PC Brand: $150

PRE-C
Thorough "Lint"-like Analysis Now on the PC

Unix users have always had "lint" to thoroughly clean programs before they disappear into a compiler.

Pre-C™ looms larger than "lint". It finds problems your compiler won't. Problems that a debugger will have trouble figuring out. Even problems which will cause trouble with other compilers.

Pre-C finds all the syntactical trapness that will blow out a compiler and much subtler problems: code which will never be accessed, casts with suspect conversions, variables declared so external but never used, functions never called, machine-dependent expressions which inhibit portability, obsolete usage.

But the big service of "lint" is the Complets work with one module at a time. They know nothing of other modules which only meet up at link time. Pre-C looks at all segments of your program at once and reports to you any inconsistencies of inter-module references.

Pre-C uses the Unix System III compiler

standard to guarantee maximum portability anywhere in the C world. There are then plentiful command line options to relax such rigor during early coding when work is enormplate.

Use purchased binary libraries? Profile them for Pre-C and it will thereafter ensure that function calls from any C program are letter perfect. A miracle worker in speeding large system development. Needs 128K minimum. (160K recommended.)

Ask for: PO99   PC Brand List: $395 $295

EXPORT QUALITY

We ship anywhere. We will prepare export documents and ship to you or your agent by preferred method. Phone or Telex order for speed. To pay by credit card, pro-

DAN BRICKLIN'S DEMO PROGRAM
Slide Show Your Latest Great Idea   OUTSTANDING

When the creator of the electronic spreadsheet called with a new program, we sat straight up in our chair. Visi-Calc™ was for businessmen, but Dan's latest is for us programmers.

Ever had trouble putting a program idea into words? Programs are systems! Words don't work. The answer: Show your program as a procession of screens.

Dan's new program makes it easy. It creates slide shows that imitate a program's screens and sequential actions.

Create a screen — a snapshot of your planned product as it runs. Anything goes: words, borders, box rules, reverse and underlining of monochrome, foreground and background color on the CGA and EGA. Copy that "slide" forward with a key-stroke, change a little, to show the next instant of run-time. Copy the slide forward again. Create a whole slide show of your program in action. It will seem like the next best thing to a working program.

Each screen is a 80x25 character mode, not the snapped graphics. All 250 characters and attributes are available from scrollable lists which pop to the screen. All commands are layered in Lotus-style pop-up menus, with frequent choices mapped to the function keys as well.

Screen areas can be blocked for cut and paste or filled with color or characters, even made to blink. Slides of disappearing sequences can be made for overlaying and any slide may have several overlays snapped to it.

Slides can proceed at timer intervals or in response to keystrokes, and depending on a user's response, you can tell the program to branch anywhere in the slide sequence to create innumerable paths through your show.

Don't make your ideas struggle through coding to get to the screen. Dan's Demo is invaluable to prototype the program you are about to write, to position all the labels, choose the color decor, smooth out the keystroke interface before it gets etched in code. It's blossomed throughout Lotus™, we hear. "Lotus [was] my major test site", says Bricklin.

Each purchase of Dan's Demo entitles you to redistribute fifty copies of the slide projector program along with your show. Plan instead, no bundle, to keep the price low because Dan thinks everyone should have one. You'll wish he'd penned Demo then and left VisiCalc for now (256K)

Ask for: N0100   PC Brand: List: $75 $69

C-DEBUGGER
Source Level Pesticide

Symbolic debuggers at least let you refer to the names you give to variables, functions, etc. in your source program — so you don't have to debug C programs by way of hex memory addresses. By contrast, switch on the C-Debugger™ source display, though, from the top or any breakpoint, and enjoy the uncanny experience of watching your source code step by, one line at a time. Or skip ahead a lines and display from there, Or browse through source from the surrounding program area—even from another file.

Multiple breakpoints can be assigned to individual lines in your source files. Areas of memory can be set read-only to let in a form of write-protection find the most elusive bugs, like pointer encroachment. Trace options allow display of function names and lines numbers as executed. Backtrace writes a history of all functions called, a roadmap of how you got lost before you crashed. (Note: host local names which the compiler doesn't map) C-debugger supports four memory models and several compilers. (256K)

Ask for: S1200   PC Brand: List: $165 $145

dBC
Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C

dBC talks C to dBASE. It creates and maintains files and their indexes which exactly replicate dBASE™ file design. So dBASE can read and update them. And the reverse: dBC™ can use any files created by dBASE. Now C and dBASE can operate on the same data bases interchangeably.

That opens up the widespread culture of dBASE [while minimizing] exploitation by C programmers, and there are a lot of dBASE users out there. You can top that market, and the recent dBASE lan-

guage, and gain all the advantages of C with this single product.

dBC's functions parallel all dBASE's file handling commands, many decomposed to give closer control. The manual discusses each backed by demo source files on disk.

Use dBC for custom work for clients, or on even. It's a complete ISAM file manager for C whether or not dBASE will be used in tandem, supports all four memory models and can have sixteen index and data files open. Big discount to buyers of both dBASE II and III versions: Specify Lattice, Microsoft 3 x, or DeSmet compiler.

Versions	List	PC Brand
LC01 for dBASE II	$250	$225
LC03I With Source	$490	$450
LC01 for dBASE III	$250	$225
LC31I With Source	$490	$450

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Enhanced Printer Options Mark Epson and Panasonic

BY PHIL WISWELL

New dot matrix printers from Epson and Panasonic exemplify a trend about in printer design. These printers offer a variety of print enhancements that can be set directly from the front panel, a handy option when your software doesn't support the printer feature you need or you don't want to bother entering a batch of escape codes.

Epson Boosts Speed

The wide-carriage Epson FX-286 is a faster, more versatile version of Epson's popular FX-185, offering 136 columns at a claimed 200 characters per second in draft print mode, 40 cps in near-letter-quality mode. On PC Magazine Labs' printer benchmark tests, the FX-286 averaged 94 cps in draft and 30 in NLQ mode, making it 17 and 30 percent faster, respectively, than the FX-185. (The FX-185 was introduced in mid-1985 and lasted only 6 months before it was superseded by the FX-286.) The regular carriage, 160-cps

Enlarged font sizes show different type styles and roughly equivalent quality in the draft and near-letter-quality modes of the Epson FX-286 (top) and the faster Panasonic KX-P1595 wide-carriage printers.

claimed (80-cps actual) FX-85 continues unchanged.

The FX-286 has an 8K-byte buffer as standard (32K is optional), preventing it from tying up your computer during printing like so many printers with smaller buffers do.

The printhead has nine pins that produce a 9 by 9 arrangement in draft mode and 18 by 18 in NLQ mode. The mechanism prints bidirectionally using logic seeking (unidirectional in graphics mode). It comes with Roman, italic, special international, NLQ, and both IBM character sets. DIP switches alternate the FX-286 high order character set between Epson italic and IBM Proprinter graphics characters. Tractor and friction feed are built-in, too. An automatic sheet feeder is $315.

The most attractive feature of the new printer is SelecType, a method for programming the FX-286 for ten different type styles by manipulating the on/off line, form feed, and line feed buttons. It's a bit convoluted to learn, but once memorized gives you all the flexibility many software packages leave out, allowing you to select from the following modes and their combinations: condensed, double-bale-width, elite, emphasized, italic, double-strike, underlined, super- and subscript, and perforation-skip (great for printing program listings with top and bottom margins).

Panasonic KX-P1595

Panasonic has produced another winner with its KX-

P1595, which resembles the rest of the Panasonic printer line in appearance and performance. It's a sturdy, sensible, easy-to-operate printer with more than its share of useful extras. Print speed is rated at 240 cps in draft mode, 51 cps for near-letter-quality. In actual PC Labs testing, the KX-P1595 averaged 116 and 42 cps respectively. (With dot matrix printers, optimistic speed claims are the norm.)

This nine-pin printer has three built-in fonts—draft, near-letter-quality, and bold-face, proportionally spaced near-letter-quality—selectable from the front panel. With the KX-P1595's five character pitches—10, 12, 15, and 17 characters per inch and 17 characters per inch and proportional—chosen from another button on the front panel. A forms-length control lets you dial in 3- to 12-inch forms, remarkably simpler for nontechnical users.

Thoughtful touches make Panasonic really make this printer shine. For example, the top of the printer has four ruler lines that correspond to 10, 12, 15, and 17 cpi settings. A paper edge guide on the left side of the ruler "clicks" at each setting, so that precise margins do not have to be guesswork. Also, the paper separator is of single-piece construction to prevent jamming. An automatic cut-sheet feeder is optional. Both serial and parallel ports are standard.

The unit emulates either Ep-

son or IBM Graphics printers and uses Diablo 630 codes.

KX-P1080: Few Frills

Panasonic also introduced its new KX-P1080 low-end printer, featuring a regular-width carriage and a 100-cps speed rating. In the PC Labs tests, the KX-P1080 averaged 77 cps in draft-print mode and 20 in near-letter-quality mode.

It doesn't offer many frills, but a three-position front-panel switch selects draft, near-letter-quality, and 17 condensed-print modes through a switch on the front panel.

The KX-P1080 is of sturdy construction and offers a small footprint. At $319 list, it's an affordable workhorse.

CD-ROM Conference: Lured By 600 Megabytes on Disk

PC SHOW REPORT

BY CRAIG L. STARK

SEATTLE, Wash.—With approximately 1,000 participants generating an enthusiasm not seen at recent Comdex shows, the First Microsoft CD-ROM Conference brought together publishers and programmers for 4 days to explore a medium that can store 600 megabytes on an optical disk less than 5 inches in diameter.

Like the now-familiar audio compact disks, CD read-only memory disks use a laser to write a pattern of tiny pits (approximately 0.3 microns in size) and spaces on the surface of a master disk. Proven massproduction techniques make it feasible to create large numbers of low-cost duplicates from each master disk. The ability to use existing audio CD production facilities, technology, and the same types of player mechanisms gives CD-ROMs the potential to open up access to massive databases that could appeal to a very broad market.

Grolier Encyclopædia

Exemplifying the current CD-ROM state of the art at the conference was the *Grolier Electronic Encyclopedia*. A single $199 CD-ROM disk ($995 with a Romulus CD-ROM drive, controller card, and cable for the PC) encompasses the entire 20-volume, 9-million-word encyclopedia and also contains flexible, full-text retrieval software from KnowledgeSet (formerly Activenture).

Besides giving the keynote address at the conference, KnowledgeSet president Gary Kildall also announced a joint venture with the Digital Audio Disc Corporation. Based in Terre Haute, Ind., DADC is a wholly owned subsidiary of Sony that currently presses audio CDs and will shortly press CD-ROMS. The combined venture will offer complete single-

site CD-ROM production facilities that include formatting, mastering, and replication.

The New Papyrus

CD-ROM: The New Papyrus (Microsoft Press, 1986, $34.95), a 620-page book with some 50 articles prepared especially for the conference, af-

fords yet another illustration of what can currently be done with existing CD-ROM technology. In the space of 3 weeks—using only an IBM PC AT, the *Blue Fish* full-text retrieval software from Computer Access Corp., and the CD-Publisher system from VideoTools—the necessary 9-track production tape was prepared, sent to N.V. Philips in Eindhoven in the Netherlands, and a CD-ROM version of the book was produced. Mastering and pressing 50 disks (just 0.4 percent of the disk sur-

face as required) in Eindhoven cost only $4,000.

Since the disks are clearly suitable for use as unalterable, massive repositories of medical, legal, financial, or library catalog data, obvious CD-ROM applications include servicing specific vertical markets. Many of the conference speakers,

> The ability to use existing audio CD technology gives CD-ROMs potential access to massive databases.

however, including Microsoft's Bill Gates and Borland International's Philippe Kahn, stressed a broader prospect. Apart from their use as computer peripherals, CD-ROMs offer an opportunity for developing low-cost "interactive readers" that will support sound and graphics as well as text. Such different applications as a demonstration "Multi-Media Encyclopedia" program from Microsoft, interactive game format programs, and navigational driving aids can use the enormous storage

potential of the disk to appeal to a wider public that would otherwise have little interest in computers. Developing the appropriate human interfaces for applications like these will necessarily draw upon the skills and experience of traditional "information providers" such as publishers, as well as the expertise of programmers.

Much Work to Be Done

If the conference opened vistas, it also pointed out the considerable work that remains to be done. An ad hoc consortium known as the High Sierra Group, chaired by John Einberger of Reference Technology and consisting of members drawn from all sectors of the optical community, is completing work on a standard for logical formatting of CDs (the physical formatting has been standardized by Sony and Philips) to ensure their interchangeability.

Only a week before the conference, a joint announcement by Philips and Sony of a preliminary CD-I (Compact Disk-Interactive) standard made some people think—mistakenly—that the regular CD-ROM might be rendered obsolete before its introduction. Developing the software to retrieve information rapidly from a disk whose contents would take an entire week to transmit via a 1,200-bit-per-second modem is by no means simple, as Bill Zoellick of TMS Inc. in Stillwater, Okla., and numerous other vendor representatives pointed out. Nor is it easy to work out licensing requirements to protect the legitimate rights of authors and publishers when whole encyclopedia articles can be copied in an instant and run through a possible "auto-paraphraser" program.

But even if problems like these remain, the promise that CD-ROM offers clearly justifies their solution. As conference chairman Bill Gates noted, computer memory availability has tended to track memory requirements in an evolutionary way—relatively small increments at a time. CD-ROM represents a quantum jump in which quantitative change has clearly become qualitative. 🖪

AutoMentor Builds Demos And Interactive Tutorials

🖹 FIRST LOOK

Training and education are only two of this program's uses.

BY FRANK J. DERFLER, JR.

Software Recording Corp. of America's new AutoMentor gives software developers the tools to easily construct standalone on-screen lessons or a demonstration of almost any application's program.

AutoMentor can be used to create illustrations, annotations, or complete lessons.

In software-related applications, AutoMentor can capture frozen screen pictures to be replayed in slide-show fashion. (In this respect, it's similar to Dan Bricklin's Demo Program (see page 54). With Bricklin, there is no link to other programs: you create screens from scratch.) Alternatively, Auto-Mentor takes control of an applications program and runs it while windows of explanatory text or questions are laid over the active screens. It could, for instance, start 1-2-3, create a worksheet template, go to a range of cells, and then with a blinking box and arrow, indicate to the user, "Fill in first-quarter sales and profits here."

Both the screen-capture and program-running modes allow for interaction, on-screen comments and explanations, visual and auditory effects, and branching based on certain conditions.

An Educational Tool

In an educational or training setting, AutoMentor can create text screens with test questions and explanations in a traditional programmed learning model. The program's menu and branching capabilities let it

course designer put together lessons with automatic reviews of weak areas, reinforcement of new concepts, and bypasses of mastered material.

As you create an AutoMentor lesson or demonstration, the program uses a videotape metaphor and illustration. VCR terms such as rewind, tape counter, play, and record make the operation of the program familiar and comfortable. This tape format lets you step

can be called under a variety of conditions.

Menus, branching, and the availability of flexible and colorful windows make AutoMentor a good tool for building program explanations and illustrations. You can use the extended PC character set, including graphics characters, and an excellent palette display helps you quickly select background and foreground colors for windows and menus. You

AutoMentor's menu, here overlaid at the bottom of a 1-2-3 worksheet, uses tape or VCR metaphors such as "record," "play," and "rewind" to describe its functions.

through presentations and move the chain of screens and commands back and forth to insert, delete, or modify screens, windows, and menus. At a menu or decision point, you can branch off to prestored "tapes" of the appropriate screens and text. The only limitation is disk capacity. A large tutorial can contain thousands of screens and dozens of different tapes that

can pan portions of a frozen screen in color to highlight particular points.

AutoMentor is memory resident and doesn't run with some other memory-resident software, including ProKey and SideKick. Nor does it work with programs that grab the screen or filter keyboard inputs like Vokswriter. With two popular graphics programs, ExecuVi-

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AutoMentor is a formidable piece of software that should do a great deal to improve the tutorials and demonstrations available for other more mundane programs.

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sion and PCPG, I was unable to pass a Ctrl-Ins command needed to call AutoMentor, and so couldn't create graphic illustrations for a programmed text. I did, however, make a live running tutorial with the Crosstalk XVI communications package that worked well.

Voice Synthesis Soon

Eleanor Dinovitz, marketing manager at Software Recording Corp. of America, says that versions of AutoMentor designed to work with graphics programs and to interface with the Texas Instruments voice-synthesis module are now in the beta testing stage; delivery is expected by midyear. Oral instructions can be digitized, stored to disk, and then played back later.

AutoMentor is not priced for a teacher's budget, although it would have a lot of value in school. A $995 starter package allows you to record tapes and play them back, while a run-time version that allows you to make 100 running programs is $2,995. Additional packages are $8 to $12 each.

AutoMentor is a formidable piece of software that should do a great deal to improve the tutorials and demonstrations available for other, more mundane programs. It's a natural for the corporate-training market as well as for educators with large budgets. 🖉

WordStar 2000 Picks Up Speed

▶ FIRST LOOK

BY BARBARA KRASNOFF

At the very least, you have to admire *WordStar*'s staying power. The original was one of the first word processing programs for the microcomputer, and today users maintain such an intense love/hate relationship with it that a discussion between *WordStar* enthusiasts and detractors can come to resemble a verbal gang war.

One reason that *WordStar* is still so evident on the marketplace may be MicroPro's attention to the faults of its own product. Last year, in order to make its word processor more palatable to a wider user base, MicroPro introduced *WordStar 2000* and *WordStar 2000 Plus*. Now MicroPro has come out with an update of these two programs.

While the first version of *WordStar 2000* retained such *WordStar* features as a Ctrl-key command structure and dropdown menus, MicroPro changed many of the elements that made the original *WordStar* so difficult for new users to learn. For example, the Ctrl-key commands are based on a more mnemonic system (which may be a hindrance if you're already "programmed" for the original *WordStar* command keys), the alternative command system using shifted and unshifted function keys and Alt-key combinations has been made easier to use, and the entire program has been generally overhauled to improve its user interface.

More Tortoise Than Hare

The first *WordStar 2000* had interesting new features. One was using style forms as overlays instead of formatting a file from within. For example, overlaying a manuscript form on a file would automatically give you double-spaced, ragged-right text, while a business

letter form would be single-spaced and justified. (You can alter and save these forms.) MicroPro also included very slick mail-merge, spelling-checker, and key-assignment functions and, in *WordStar 2000 Plus*, threw in a communications program, mailing-list manager, and indexing program for good measure. Although the first version had all these assets, it had one major flaw: it ran like a reluctant tortoise. Just moving a block of text from point A to point B meant a wait of several very long seconds.

This problem was so obvious that MicroPro quickly went to work on it. Release 2 was designed to speed up the program, and for the most part it does a good job. The scroll still tends to protest if you hold your finger down too long on the cursor key, but it gamely keeps going rather than stopping altogether. In fact, although Release 2 is no speed demon, it certainly runs at quite a reasonable pace.

The package comes with a daunting amount of paperwork: seven disks, a training guide, an installation guide, a reference guide, and a *Plus* guide that details the *TelMerge*, *MailList*, and *StarIndex* features. There

are also several loose papers, such as a warning on how to install the new version for those who already have *WordStar 2000*. Release 1.0: offers for free DCA conversion and a RAM-resident version of the program; two command cards (one for *WordStar 2000* and one for *Plus*), a keyboard overlay, and information about MicroPro's interesting telephone support service.

MicroPro's usual telephone support is limited to approximately 6 hours daily. If you feel you need more individualized support, you can pay an annual fee of $95 for membership in a premium service plan.

Document History

Release 2 also boasts several new features, which, although not necessary to the proper working of a word processor, are certainly very nice to have. One of the most interesting is a "document history screen," which appears by default whenever you begin a new document. This screen is meant to help you keep track of data about your file, including its title, author, the operator, distribution, key words used, and any other comments. It also automatically keeps track of the start date, the date the file was last modified, and the keystroke count.

Another nice addition is a two- or three-column formatting feature that is helpful in creating newsletters and such. Once you have chosen that par-

ticular option, Release 2 will automatically wrap columns to fit on 8½- by 11-inch paper.

MicroPro has added a memo form to its other style sheets that automatically supplies the format of a typical interoffice memo to your manuscript. It has also added automatic hanging and paragraph indents, tightened up a few of the already existing functions, and made several improvements in its telecommunications and indexing programs.

Finally, the company has made a "RAM version" available to users who have PCs with at least 512K bytes of memory. By replacing two of the format overlays by one specially configured for high memory, MicroPro has enabled the program to operate in the way most RAMdisk programs do.

As it stands, Release 2 is an excellent, all-around corporate word processor that is sophisticated enough to handle a multitude of word processing needs. Although it might be a little daunting to a new user, anyone who has the patience to go through its thorough tutorial should have no trouble making full use of its capabilities. ▪

WordStar 2000 Plus supports multiple-column printouts, as shown in the screen above. Release 2 has speed improvements and features of interest to the corporate user.

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Cullinet's INFOGATE is the first personal computer product to allow a wide range of different microcomputer spreadsheets, databases, word processors, and graphic software to talk to the mainframe and to each other. INFOGATE provides users of 1-2-3," Symphony," dBASE," Multimate," and other software with direct access to the corporate data needed for their PC applications. For users of multiple PC products, INFOGATE also makes it possible to easily exchange data between products. INFOGATE—stand-alone or with Cullinet's Information Center Management System—it only costs $300. Call Cullinet's toll-free number 1-800-551-4555 today!

Cullinet

Micrografx Windows "DRAW!" is a $199 graphics program that uses the Microsoft Windows–standard interface.

Micrografx "DRAW!" Runs on Windows

Last July, Micrografx Inc. introduced *In*A*Vision*, the first software product from an independent vendor to be written to the *Microsoft Windows* standard. *Micrografx Windows "DRAW!"* is the second Micrografx package to take advantage of this increasingly popular interface standard.

"DRAW!" can produce presentation graphics from *1-2-3* and *Symphony* spreadsheets and allows the user to manipulate drawing elements like text labels, titles, fonts, colors, line styles, and width patterns. "DRAW!" also allows freeform drawing, features a library of predefined images, and outputs to any *Windows*-compatible plotter or printer. Users must have *Windows* installed to run "DRAW!"

List Price: $199. Micrografx Inc., 1820 Greenville Ave., Richardson, TX 75081; (800) 272-3729.

CIRCLE 631 ON READER SERVICE CARD

Graph-in-the-Box: Memory-Resident Graphics Software

New England Software's *Graph-in-the-Box* adds a new twist to creating charts and graphs by taking up residence in your PC's RAM.

Once loaded into memory, *Graph-in-the-Box* waits for you

to hit a predetermined "hot key." It then pops up within your primary application and allows you to swap data with it, letting you capture numbers out of your spreadsheet, database report, or word processor documents. You can then reinsert the completed chart or graph into the primary application and eventually output the result to a printer or plotter. Graph-in-the-

Box's compatible programs include *1-2-3*, *Multiplan*, *WordStar*, *MultiMate*, *dBASE II* and *III*, and *R:Base 5000*.

List Price: $97.60. New England Software, Greenwich Office Park 3, Greenwich, CT 06830; (203) 625-0062.

CIRCLE 630 ON READER SERVICE CARD

Data Sentinel Keeps Watch On Personal File Security

Anyone who has tried to keep sensitive data secret knows how hard it can be to thwart a determined pair of prying eyes. The Data Sentinel, from Rainbow Technologies Inc., provides a hardware solution to the data security dilemma.

The Data Sentinel employs a hardware "lock" that you install before plugging the printer cable in your PC's parallel port. Using the menu-driven software, the user then determines which files are to be protected and what method of encryption is to be used. No other user can access the secured files unless the corresponding key is insert-

ed into the lock.

The Data Sentinel uses both the government's Data Encryption Standard (DES) and a Rainbow proprietary method. Rainbow offers three versions of the Data Sentinel: the Individual Key, which locks individual workstations within a Master system; the Master Key Set, which unlocks all computers within a system; and the Personal Key Set, which works on one computer only and has no corresponding master key.

List Price: Individual Key, $200; Master Key Set, $450; Personal Key Set, $295. Rainbow Technologies Inc., 17971 Skypark Circle, Suite E., Irvine, CA 92714; (714) 261-0228.

CIRCLE 629 ON READER SERVICE CARD

VOTAN VPC 2000 Speaks to Voice Recognition Needs

The VPC 2000 Voice Card from the Fremont, Calif.–based VOTAN Corp. is a half-length voice-recognition card for IBM PCs, XTs, and compatibles that accepts user-defined voice commands as if they were input from the keyboard. The VPC 2000 can remember up to 640 commands after an initial programming session where users tie oral commands to appropriate key strokes.

The VPS 2000 can accept commands given over the telephone, and its digital recording and playback capabilities make it ideal for telephone message management. VOTAN says its markets will probably be telemarketing and data processing.

List Price: $2450. VOTAN Corp., 4487 Technology Dr., Fremont, CA 94538; (415) 490-7600.

CIRCLE 628 ON READER SERVICE CARD

Emerald Technology Deals Its Terminal Emulation/ Synchronous Modem Card

The PC/5251 MATE is the first product to combine 5251 terminal emulation and a synchronous modem on a single full-

HOT PROSPECT

Electrohome's ECM 1311 Color Monitor Automatically Adjusts to Graphics Cards

The Electrohome ECM 1311 is a color monitor that can handle any color/graphics card with a frequency range between 15.0 and 34.0 kHz. This includes popular models like IBM's Color/Gra-

The Electrohome ECM 1311 color monitor ($1,195) automatically adjusts for most video adapters, including IBM's CGA, EGA, PGC.

phics Adapter, Enhanced Graphics Adapter, and Professional Graphics Controller. The monitor produces up to 720- by 540-pixel resolution. While similar to the NEC JC-1401P3A Multisync monitor, the Electrohome 1311 scans in vertical as well as horizontal modes. The ECM 1311 features long-persistence phosphor and a 0.31-millimeter dot pitch and connects to the PC through a standard BNC monitor cable.

List Price: $1,195. Electrohome Ltd., 809 Wellington St., Kitchener, Ontario, Canada N2G 4J6; (519) 744-7111.

CIRCLE 632 ON READER SERVICE CARD

New on the Market

(continued from preceding page)

length expansion card. It also features comautodialer software.

Jointly developed by Software Systems Inc. and Universal Data Systems and marketed by Emerald Technology Group Inc., the PC/5251 MATE enables the PC to communicate with IBM's Systems 34/36/38 family of minicomputers. It also enables 2,400-bit-per-second, 210C-compatible dial-up operations. A 4,800-bps option is also available. Hitting Alt-Esc toggles users between 5251 mode and DOS, making it possible to transfer files between the two modes.

The PC/5251 MATE's autodialer software supports automated sign-on and unattended operation.

List Price: 2,400 bps, $1,395; 4,800 bps, $1,495. Emerald Technology Group Inc., 1601 116th NE, #102, Bellevue, WA 98004; (206) 462-8200.

CIRCLE 606 ON READER SERVICE CARD

Key Tronic's KB 3270/PC Brings 122-Key Layout to Microcomputer Keyboard

Micro-to-mainframe users tired of trying to jam the IBM 3270 keyboard's 122 keys worth of functionality into the PC's and XT's 83-key (and the AT's 84-key) layouts might consider this new keyboard from Key Tronic Corp.

The KB 3270/PC features the 122 keys of a 3270 terminal, including 24 function keys, and is plug-compatible with the IBM PC, XT, and AT. It works with most popular 3270 emulation

Key Tronic's $326 KB 3270/PC keyboard brings the IBM 3270's 122-key layout to the PC, XT, and AT.

packages now available on the market, including IRMA, CXI, ATTACHMATE, and FORTE.

List Price: $326. Key Tronic Corp., P.O. Box 14687, Spokane, WA 99214; (509) 928-8000.

CIRCLE 627 ON READER SERVICE CARD

Prime Computer Terminal Is Now XT-Compatible

Prime Computer Inc., a big mover in the minicomputer market, has released a series of IBM-compatible hardware upgrades that will turn the company's T-200 terminals into XT-compatibles running MS-DOS 2.11, while still functioning as minicomputer workstations. Users will be able to have and use both configurations at the same time, toggling between minicomputer and various DOS applications software.

The upgrade kit includes a systems unit, a box with the option slots, and five IBM-compatible option slots, two of which are available for peripheral hardware. The kit is available only as an upgrade or replacement for Prime terminals.

List Price: Floppy-based XT only, $2,290; with 10-Mbyte hard disk, $3,690; terminal and XT option together, $4,300. Prime Computer Inc., Prime Park, Natick, MA 01760; (617) 655-8000.

CIRCLE 623 ON READER SERVICE CARD

Hewlett-Packard's Laserjet 500 PLUS Printer Adds Expanded Paper Handling

Hewlett-Packard Co. has added a new printer with more powerful paper-handling capabilities to its 8-page-per-minute Laserjet series of laser printers.

The HP Laserjet 500 PLUS ($4,995) adds advanced paper-handling capabilities to the Laserjet line of laser printers.

The Laserjet 500 PLUS supports two 250-sheet paper bins and a 250-sheet output bin, instead of the single 100-sheet input and 20-sheet output bins of the $2,995 Laserjet and the $3,995 Laserjet PLUS. It allows users to select among the two input bins either from the printer's front panel or from the PC's keyboard. The new printer delivers pages face down, eliminating reordering, and separates different print jobs in the output bin. The Hewlett-Packard Laserjet 500 PLUS is compatible with both parallel and serial interfaces and is fully software-compatible with earlier Laserjet models.

List Price: $4,995. Hewlett-Packard Co., 3000 Hanover St., Palo Alto, CA 94304. Check local phone book for local Hewlett-Packard sales offices.

CIRCLE 624 ON READER SERVICE CARD

Tecmar's 640 Plus Memory Board Uses Lotus/Intel/Microsoft Specifications

Tecmar Inc., introduced an extended memory card that adds up to 2 megabytes of Lotus/Intel/Microsoft-approved extended-memory specifications above and beyond the standard PC 640K-byte limit.

The 640 Plus card comes in four configurations, ranging from 256K to the full 2 megabytes. Users also have the option of buying the minimum configuration and filling the 640 Plus out with readily available

RAM chips. In addition, up to four fully populated boards can be installed in a PC to add a maximum of 8 megabytes of RAM.

List Price: 256K, $475; 2 Mbytes, $1,396. Tecmar Inc., 6225 Cochran Rd., Solon, OH 44139-3377; (216) 349-0600.

CIRCLE 625 ON READER SERVICE CARD

Quadram Accelerator Card Exceeds AT Speed on PCs

Quadram Inc., the Norcross, Ga.–based peripherals giant, has introduced an 8086-based PC accelerator card that mimics the capabilities of an Intel 80286 processor.

The SuperSprint card uses a switchable 8- or 10-MHz Intel 8086 central processing unit to effect a speed boost of up to 60 percent faster than the AT's stated clock speed of 6 MHz. It further increases valuable computing speed by holding the last 32K bytes of program code used, as well as an image of the most 96K RAM, in two separate caches on the board. The Quadram SuperSprint card is fully compatible with all leading software packages and extended memory boards. It includes built-in support for an optional 8- or 10-MHz 8087 math co-processor.

List Price: $695. Quadram Inc., One Quad Way. Norcross, GA 30093; (404) 923-6666.

CIRCLE 622 ON READER SERVICE CARD

■ PC UPDATE ■ VIRGINIA DUDEK

Paradox, Version 1.1, from Ansa Software adds an applications generator and automatic multiple-file data entry capabilities and removes copy protection from this relational database, which was introduced last September. The upgrade is free to registered users; $19.95 to others. Company president Steve Dow said the removal of copy protection was a result of user feedback. Contact Ansa at 1301 Shoreway Rd., Belmont, CA 94002; (415) 940-2030.

In the wake of the introduction of its downsized **Compaq Portable II,** Compaq Computer Corp. of Houston, Tex., reduced prices of its 8086-based portables, by $500 on the Compaq Portable with dual disks to $2,199 and by $800 on the **Compaq Portable Plus** with 10-megabyte hard disk to $3,199. Prices for Compaq's 8086- and 80286-based desktop and portable units remain unchanged.

Ashton-Tate of Torrance, Calif., has released Version 3.60 of **MultiMate Advantage Professional Word Processor.** Features include columnar operations, a 40,000-word thesaurus, a typewriter mode, line and box drawing capabilities, automatic footnoting, forms generation and fill-in, and table-of-contents generation. Through April 30, Version 3.60 will be bundled with **GraphLink,** a graphics and text integrator, and **MultiMate On-File,** a file-management system. Upgrades are $60.

MicroPro International of San Rafael, Calif., has announced LAN installation kits and corporate licensing agreements for **Word-Star.** IBM's PC Network, Novell's Netware, and 3COM's Ethernet are now supported by WordStar. Suggested licensing fees for WordStar are $160 per workstation for three to nine workstations and $140 each for ten or more after the purchase of one WordStar package at $350. Licensing fees for WordStar Professional are $225 and $195, respectively, after the purchase of WordStar Professional at $495. LAN installation kits and licensing agreements are available from MicroPro dealers.

Lotus Development Corp. of Cambridge, Mass., says it is investigating incompatibility and technical problems found between Versions 1A and 2.0 of 1-2-3, according to Alexis Driscoll, associate product manager for 1-2-3. "The problems labeled 'incompatibility' are not from software bugs but are the result of adding new functions to the program," says Driscoll. Reported problems include: Version 1A treats labels as zeros when referenced in formulas, and the new release returns an error message; difficulties with the program that makes Version 2.0 files compatible with Version 1A; differences in the worksheet "wrap around" function. Lotus declined to discuss plans for a patch disk or another version of 1-2-3.

Kaypro Corp. of Solana Beach, Calif., has released a hard disk version of the **Kaypro PC,** an IBM PC-XT–compatible. The $1,995 Kaypro has a 20-megabyte internal hard drive, a double-density 360K-byte disk drive, 256K internal memory (expandable to 768K), and an AT-compatible keyboard.

Short Takes: Analytics International Inc., of Arlington, Mass., has upgraded **ManoGrafx,** a chart-preparing program. Version 2.2 contains **Replay!,** a built-in keyboard macro processor. Call Analytics for upgrades.... Ferox Microsystems of Arlington, Va., has cut the price of **ENCORE!,** a financial-modeling program, from $895 to $475.... Index Technology Corp. (InTech) of Cambridge, Mass., announces Version 1.6 of **Excelerator,** a systems analysis and design package. Enhancements include expanded analysis and graphics functionality, and new options for text input. Version 1.6 is free to customers covered by warranty or the maintenance plan and is available to other customers for $500.... Ashton-Tate of Culver City, Calif., has released the **dBASE III Plus LAN Pack,** enabling four users to share **dBASE III Plus** on a local area network. Now, more than one person can access a file without corrupting data. Programs and files done on **dBASE III** can be converted to **dBASE III Plus.** The LAN Pack sells for $995.... Digital Communications Associates of Alpharetta, Ga., has cut $100 from the price of **Smart Alec,** a micro to IBM System 34, 36, or 38 communications link product that allows PCs to emulate an IBM 5251 Model 11, 5291, or 5292 Model 1 terminal. **Smart Alec** now sells for $895.... Office Solutions of Madison, Wis., has released Version 4.0 of **OfficeWriter.** Registered users will receive an upgrade kit. Upgrades are $55 for current owners; $170 for others.

PC Update reports on software and hardware enhancements. To contribute, write or call PC Magazine, One Park Avenue, New York, NY 10016; (212) 503-5255.

Bricklin's Demo Program Breaks Original Ground

■ FIRST LOOK

BY RICHARD AARONS

Dan Bricklin's Demo Program is a winner right out of the starting gate. This remarkable piece of C and assembly language code is a wholly new concept in programming development.

Dema allows you to create, edit, and view a series of screens or "slides." Each slide can be an image of what a running program looks like, created from any of the 250 displayable ASCII text and graphics characters. (Bit-mapped graphics aren't supported.) Text can be in normal, underlined, blinking, or color mode.

Bricklin makes excellent, intuitive use of the IBM keyboard and function keys to enable you to draw slides (screens) concisely and rapidly. Corrections are made by overstriking characters. *Dema* has its own learnmode macro facility to help with repetitive operations.

On-Line Creations

After individual slides are created, they can be strung together in a slide show that simulates the speed and smoothness of the real program. Transition from screen to screen can be timed or dependent on a response from the keyboard. You can even program in a simulated disk drive access.

Dema's documentation comprises 29 single-spaced pages of concise but understandable nononsense text plus an on-line demonstration obviously produced by the program.

Dema is much like the world's first spreadsheet. Until the spreadsheet was invented, people didn't know how much they really needed one. Now they can't imagine life without them. After you use *Dema* once, you'll wonder how you got along without it.

Why the Hercules Color Card is better for your XT than IBM's.

Did you know that there's a color graphics card specially designed for the XT? It's called the Hercules™ Color Card. We think that it's better for your XT than the IBM® Color Graphics Adapter. Here's why.

The XT comes with an empty short slot. IBM's card is too long to fit in it, so you're forced to sacrifice a valuable long slot, while your XT's short slot goes unused.

The Hercules Color Card is designed to fit in this short slot. It's the smartest way to maximize the usable slots in an XT and provide for your future expansion needs.

IBM   Hercules

Notice how much more efficiently Hercules makes use of the XT's slots.

Our efficient use of an XT's slots is not the only reason to buy a Hercules Color Card instead of IBM's. We give you a parallel printer port at no extra cost. (IBM charges extra and takes up another slot.)

A lot of people wonder how Hercules can do everything that IBM can in a card less than half the size. We do it by designing our own graphics microchips. Just one of our chips packs the punch of dozens of IBM's, reducing by more than 50% the number of components that can fail.

And we'll do just about anything to make our products the most reliable you can buy.

Hercules   IBM

Of course, you *will* have to give up something when you buy a Hercules Color Card. You'll have to give up software incompatibility. With Hercules, there is none. Every program that runs on the IBM color card will run on the Hercules Color Card.

You'll have to give up IBM's ninety day warranty. Ours is two years.

Compare warranties

| IBM | 3 months | |
| Hercules | | 2 years |

And you'll have to give up a dollar. The Hercules Color Card is $245—IBM's is $244.

Look into the Hercules Color Card for the XT, PC or AT. Find out why the readers of *PC World* voted the Hercules Color Card 1985's best color graphics card—ahead of IBM's. Call **1 800 532-0600 Ext.420** for the name of the dealer nearest you and we'll rush you our free info kit.

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CIRCLE 146 ON READER SERVICE CARD

PRD+ Mks Qk Wk Of Oft Usd Wds

FIRST LOOK

BY CHRISTINA DYAR

Itatin may not make sense to you, but it does to *Productivity Plus (PRD+)*, a shorthand program for PCs. *PRD+* converts abbreviations into full words or phrases. *Itatin* translates into "it has come to my attention."

Working in conjunction with word processors, spreadsheets, database managers, and graphics programs, *PRD+* does its work without much effort.

The software cross-checks input against predefined word lists, and, as you enter abbreviations, punctuation, returns, or spaces, *PRD+* enters the corresponding words.

Shortcut to Shorthand

Abbreviations can be any combination of characters you choose to represent a word or phrase. The program comes with calendar and state abbreviations, 200 commonly misspelled words, and 100 frequently used words of four characters or longer, such as *hve* for "know," *evr* for "every," and *shd* for "should."

The standard list also contains salutations, closings, and common business expressions: *acon* for "according to our conversation of," *wasap* for "I will let you know as soon as possible," and *ifqs* for "if you have any question."

You can customize the standard list and create new word lists with your own abbreviations. Each abbreviation can stand for up to 240 characters of text.

A keyboard enhancer such as *ProKey* or *SmartKey* could turn a single Ctrl- or Alt-key combination into several hundred (or thousand) keystrokes, but they'd be limited to only a few dozen phrases and wouldn't insert text as fast.

The Chemist's Friend

With *PRD+*, mathematical formulas and DOS command sequences can be abbreviated. So can spreadsheet macros. A chemist, for instance, could enter *ccl* instead of carbon tetrachloride. You can also import data from another software program to a *PRD+* word list. Lists can be merged or deleted to produce one list of up to 40,000 characters.

The memory-resident package is guaranteed compatible with *Framework*, *dBASE III*, *Enable*, *Framework*, *1-2-3*, *PFS:WRITE*, *Volkswriter Deluxe*, *Word Perfect*, *WordStar*, and 13 other popular software packages; it can be customized to run with just about any software that doesn't take command of your keyboard.

Templates for the medical (*MED+*), insurance (*INS+*), brokerage (*BRK+*), and legal (*LGL+*) professions will be available soon. So will a Stenoscript word list for those familiar with Stenoscript ABC Shorthand.

COMMUNES ■ EDITED BY BILL HOWARD

Debbie Does DOS

To get its name in front of the public, Sperry Corp., best known for the kind of mainframes that run airline reservations systems, is aggressively seeking to have its equipment used in Hollywood movies. According to Sperry executive John Wise, new flicks starring Whoopi Goldberg and Kirk Douglas will spotlight Sperry hardware.

Recently, however, Sperry was forced to hire a full-time employee to read scripts for suitability. Another computer company was recently asked to loan a studio a computer system to put in front of the camera. Unfortunately, the movie turned out to be X-rated. The company? Wang.

At 40¢ a Sneeze, Who Can Afford To Get Sick?

"Super Artificial Intelligent Software" is a fancy name for facial tissue that costs nearly 40 cents a sheet.

In the search for new products to titillate its readers, mail-order house JS&A Products hit on Mighty Soft: facial tissues in a software-style ring binder and box. The price? A mere $19 for 50 sheets.

"I think the idea is stupid, the price outrageous," wrote JS&A president Joseph Silverman in the catalog (1 JS&A Plaza, Northbrook, IL 60062), "but since everybody is buying it, I won't voice my opinion too loudly."

Lessee, Howabout "Open Sesame"?

A long-running feud between a Washington, D.C., controller's office financial analyst, Alvin Frost, and city fathers erupted when someone broke into Frost's PC and printed copies of a memo critical of mayor Marion Barry. (Barry once called Frost an "imbecile;" Frost had warned against a shaky municipal investment in a firm that went bankrupt.) Frost then changed the password to his computer, which also held city financial records.

Frost, who gained his independence from the city by quitting before he was fired, dropped a few hints for the city's computer wizards and consultants struggling to crack the password: Two syllables, seven letters, and the first syllable appears four times in the Declaration of Independence. The password itself doesn't appear, but it's what the Declaration is all about.

Later, Silverman admitted, "It didn't break sales records." The company sold one box.

■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

THE PRODUCT INTRO DILEMMA

Introducing a new product is a perilous act. Should you preannounce it or keep it a secret until it's ready to ship? Either course can be dangerous, but ultimately, secrecy is better.

The computer industry has never really gotten its act together on how to introduce new products. Either they are preannounced, or there is strict secrecy right up to the unveiling.

Preannouncement would seem to be the more straightforward way of introducing products. After all, it doesn't involve the perils implied by secrecy. Preannouncements, however, produce widely differing results. There are four basic reactions to preannouncement of a product: derision, curiosity, paralysis, and calamity.

Manufacturers mostly encounter derision when their claims are wholly incapable of being substantiated. The sales projections for the late Gavilan portable are one example. Atari's projections (5 million machines in 1986) for the 520 ST are another. Someday medical science will recognize a malady known as Returnon Investmentus Dementia. The layman, however, will always know it as Spreadsheet Fever.

When you're trying to figure out how tall you're going to sit in the wallet after a new product introduction, the easiest figure to fool around with is projected sales. You may convince yourself, but unless your numbers are very conservative, you'll get hoots from everyone else.

A HEALTHY REACTION Curiosity is the normal, healthy reaction the manufacturer prays for when it preannounces a product. It hopes that enough early interest will build demand in the distribution channels, giving the product an easy birth. Too much curiosity, however, can raise expectations over what the product can deliver. Users then become disappointed and reject the product for not fulfilling promises that it never made. Paralysis is what the manufacturers both hope for and dread. They want their new offering to be so attractive that it hurts sales of their competitors' products. At the same time, they don't want to endanger the sales of their current offerings.

Calamity is the most dreaded effect of all. Some time between announcement and delivery date, something goes terribly wrong. The disaster comes from varied sources: The programmers lie about how much progress they are making. The second round of venture capital never materializes. Someone else comes out with a better, cheaper product. Or the market just evaporates. A couple of COMDEXES ago, the Business Solutions (*Jack2*) booth stood cheek by jowl with Ovation's. Both promised smooth, nearly transparent integration. The folks at Business Solutions were pleased because their demo worked, but their video show didn't. At Ovation, the video was great, but the demo wasn't ready. Calamity eventually befell both of them. *Ovation* never made it to market. *Jack2* died because it was written under the UCSD P-System instead of PC-DOS. Consumers rejected just about everything that didn't run under DOS (with the quirky exception of *Dollars and Sense*).

RUMORS IN THE WIND Secrecy is fraught with its own perils. First off, there's almost no such thing. The rumor column in our sister publication, *PC Week*, has proven that people will sell their companies down the river for a T-shirt. Heads of companies, faced with this reality, go to extreme lengths. They establish off-site development and testing facilities. They beta-test in foreign countries. They disguise products.

For instance, Compaq insiders carried the new Portable II around inside hollowed-out older Compaq computers. Their secret was safe until they circulated the machine to some of the big software houses. As big as Compaq is, it still felt obligated to get the "blessing" of the key software players and its major customers. Well, the story got out.

At what cost? Compaq hadn't finished notifying its dealers. It hadn't announced pricing, and it hadn't begun its advertising campaign. Since the machine is positioned not to compete against Compaq's existing product line, I wanted the chance to explain the machine to its dealers and the

■ FROM THE EDITOR'S SCREEN

trade press. While it's fairly obvious that the Portable II will encroach most heavily on the standard Compaq and Compaq Plus, the company's intent was to let the market seek its own level. The sooner the story gets out, the greater the chances for prejudgment.

Microsoft went through a different version of the same trauma at its recent *Microsoft Windows* Developers Seminar. Over 400 prospective developers of *Windows*-based products were on hand to learn why they should invest the time and effort of developing their next product under *Windows*.

The bottom line with *Windows* is that it is a precursor to future versions of DOS, especially in areas having to do with device drivers, memory management, and multitasking. Vice president Steve Ballmer walked the hairy line between telling the developers about future DOS features and actually making a product announcement.

COMPANY SECRETS Why, you may ask, the secrecy? Doesn't Microsoft have a hammerlock on DOS? Yes and no, as it turns out.

Microsoft has such close ties with IBM that it must be exceedingly careful about what it says. Anything that could be used to divine future IBM plans and products would be frowned upon. Also, Microsoft is not the only game in town. Many of the techniques embodied in *Windows* and future versions of DOS could be siphoned off by operating environment enhancers and even applications programs. Not only would this blunt the impact of the product, but it would divert energy from the important task of creating the next generation of applications to run in protected mode on 80286 and 80386 processors.

Which gets us back to the central issue, secrecy. You can find more snow blowers in San Diego than true innovations in the personal computer business. Most of the original ideas can be knocked off by upstart competitors in a matter of weeks. The window of opportunity for any new product, therefore, is narrow. Every leak lessens the chance that the introduction will go the way the manufacturer planned.

Perhaps you've noticed that *PC Magazine* doesn't deal in preannouncements of

products. While we work extensively with manufacturers under nondisclosure agreements, nothing is real until the product is on the dealer's shelves. That way, you're assured that the evaluations you read reflect products you can go out and buy. It's a logical extension of our "If we don't test it, we don't write about it" policy.

Heard any good secrets lately? They're safe with us. ▣

Our technicians m

With microcomputers quickly becoming the main cog in the information machinery of business the world over, it only makes sense to look for a PC products and service company that provides enthusiastic, comprehensive technical support to the corporations and individuals that buy from it. The technical staff at PROGRESSIVE MICRO DISTRIBUTORS goes that extra step to insure that your experience in computing is as trouble free and rewarding as possible.

MICRO CENTER.

The corporate microcenter is at the heart of a business's functioning, and PMD excels at keeping this vital part of your organization running smoothly. Our Technical Support Center provides compstant and quick turn around on technical assemblies and repairs. Our technical phone staff has easy access to your system's test record, since every machine is tested before being sold, and its technical record kept on-line for easy and positive access. Having this information available to our sales consultants means the advice they give you on system configurations reflects current technical finds and trends, complementing the upgrade or integration of your system.

ON-SITE SERVICE.

An on-site installation team is available to all regional customers, and special remote installations can be arranged for larger systems. We can train your users in such areas as advanced network and multi-user applications, and are always available to help with any special applications.

For the guy that always needs answers yesterday to technical problems, or needs in-depth pre-sales research on technical applications, PMD is the answer to your prayers. We cover it all, from assembly to installation to telephone and on-site support, and we're behind each step one hundred percent. So if you're looking for a company that will go that extra step, look no further—PMD can sarve all your computing needs.

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SEARCHING FOR THE BAD GUYS

Hind sight is a wonderful thing isn't it? It would be totally unnecessary if we could foresee problems before they happen. Nobody likes to make a mistake, especially those of us who work with computers.

The data strips on the right contain a program called DISC SCAN, by Charles Petzold, which appears in this issue. The program is designed to find bad sectors on a disk. Writing data to a bad sector could be devastating.

Why loose valuable time or important data when DISC SCAN can alert you ahead of time that problems exist?

Read the data strips into your PC. Run the program before you use a new disk, or before you use your hard disk. Elude "bad" sectors, and avoid any troublesome mistakes.

If you'd like to learn more about the program and its uses refer to the article in this issue.

StripWare Library No. 217

1   2   3   4

Softstrip

COMMON SENSE IN DATABASE MANAGEMENT
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Triple your PC speed for only $799!

8087 Upgrades™

MicroWay is the world leader in 8087 support. Our 8087 development software has been in use since 1982. By 1984 we had become Intel's 97th largest OEM account. When you buy from us, you can be confident that you will receive the 8087 chip designed for your PC and that our unique diagnostics will instantly verify that your processor works correctly as installed. Call for current prices.

287Turbo™

This card plugs into the 80287 socket on your AT or COMPAQ, doubling the 80287 clock from 4 to 8 Mhz. It does not change the 80286 clock speed or affect your warranty. The card comes with an 8 Mhz 80287 and has provisions for faster crystals as better 80287's become available. It also has a reset button and circuit that provide a hardware alternative to CNTRL-ALT-DEL. 287Turbo with Diagnostics and Reset $395

Number Smasher™

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CIRCLE 194 ON READER SERVICE CARD

■ PETER NORTON

DOWN WITH THE PC AT, UP WITH THE COMPAQ 286

Originally an AT ally, Norton pooh-poohed AT hard disk crash rumors until his two ATs bit the dust. Now he recommends the Compaq 286, Model 4.

Once again I'm interrupting my ongoing discussion of disk mayhem to remark on this issue's main topic—those blankety-blank AT problems—and to empty my ever-full mailbag.

Let's begin with the AT.

When they first came out, I bought two ATs, loved them, and have highly recommended the AT for serious computer users. I also pooh-poohed the reports of serious difficulties with the AT's hard disks. Although I never denied that AT owners had real troubles, I was skeptical about how widespread the problem was.

Since then, one of my two ATs has eaten its factory hard disk and has started nibbling at the edges of a replacement 30-megabyte disk. The other AT has eaten its original hard disk, two replacements, the disk controller, and its keyboard to boot.

I was rescued from this disaster by two unusual pieces of luck. First, for no good reason I'd bought a spare hard disk for my AT. Second, my original drive died gradually, giving me time to transfer my data. Most hard disk deaths aren't so forgiving, which is why I believe every system should have tape-backup capabilities.

I thought the rash of problems with my second AT might have been provoked by the electrical power supply in the office where I'm using it, because frequent brownouts occur. But in spite of the power deficiencies, the Compaq 286 sitting next to the AT has no problems, which leads me to believe that the AT itself is at fault. By comparison, the 286 is a robust machine.

Frankly, I no longer see the AT as the professional's PC of choice. Contrast it

with Compaq's top-of-the-line Deskpro 286, Model 4. IBM disapproves of putting fast crystals into ATs to speed them up (and even prevents it with the AT's new BIOS); Compaq makes the fast speed standard. IBM makes 30-megabyte disks an extra-price option (and forces you to sacrifice the fast-crystal option to get 30-megabytes); Compaq makes 30 megabytes standard on the Model 4. IBM doesn't provide for tape backup (the only way to go); Compaq makes an internal tape standard. And Compaq gives you that nifty dual-mode display and a choice of green or amber screens.

The Compaqs do have their drawbacks: they don't have that great IBM keyboard, the internal tape isn't as fast or capacious as others (such as the terrific Tecmar and Maynard units), and the dual-mode display really isn't as good as, say, using a Hercules graphics card. But I've come to the conclusion—backed up by my own re-

liability experience—that the Deskpro 286, Model 4, is the personal computer of choice, particularly if you want off-the-shelf excellence (rather than putting together a mix-and-match system). The proof of it is that I'm about to buy half a dozen AT-class machines for my office, and I've settled on the Compaq.

MY OVERFLOWING MAILBAG

My mailbag is full of notes from intelligent folks who caught my silly mistake in the boot record program that I contributed to the Programming/Utilities column (*PC Magazine*, Volume 5 Number 2). I'd wondered why my little nifty didn't work on some color-graphics PCs and similar machines. The reason was simple enough—I'd used register BX as a data pointer, even though I'd meant to use register SI (as my program comment stated); but, as IBM's documentation clearly states, some versions of the BIOS use BX to control color and display page. Sorry for my error, folks. Change all five BX references to SI and all will be well.

I've often commented on how many hard disk users get poor performance out of their computers simply because DOS is using too few disk buffers. You can control the number of buffers with a BUFFERS= statement in your start-up CONFIG.SYS file (if you don't know what this is all about, bone up on it in your DOS manual). I usually recommend at least 16 buffers and often find 32 or 64 (or even the 99 maximum) worthwhile. There's a cost, of course: every two buffers eats up 1K byte of RAM, and too many buffers can

■ PETER NORTON

actually slow down some computer operations. But, usually, the more the better. One reader, James Harrison, wrote in asking why DOS kept him waiting so long at the end of the DIR command when it re- ports the amount of free space on the disk. The problem he encountered is actually a handy and crude way of determining if we have assigned too few buffers. Use it as a simple yardstick—if DIR keeps you wait- ing, you can try upping the number of buffers you allow DOS.

THE DORAN TEST I got lots of flak about both the "Doran Test" and my comment here in my column (Volume 5 Number 2) that hard disk interleaving isn't something to mess with. Joe Doran, inventor of the Doran Test, and I have claimed from the beginning that it is a very crude benchmark of disk performance—but one that could be used in lieu of anything more sophisticated. Doran's test divides the disk's capacity (as reported by CHKDSK) by the time it takes to read the whole disk (using my DT-Disk Test program) to get a rough idea of the effective speed of the disk, including influences such as the DOS formatting and cluster size. It's not a lab standard test but it does give meaningful results, and the tools to perform it are already in the hands of most PC users. So you sophisticates stop throwing bricks at Doran's test.

Bricks are being accepted at the "don't mess with interleaving" department. The software that comes with many hard disks (and also some versions of IBM's advanced diagnostics) allows you to set the interleave factor on a hard disk, which can significantly influence the effective speed of disk operations. But you've got to be a serious tinkerer to do it. Changing the interleaving factor involves unloading the data from the disk, doing a hard reformat (changing the interleave) and then a "soft" (DOS) format of the disk, reloading your data, then testing to see if the disk operations that you do are faster or slower. I wouldn't dismiss the idea as a way of improving the performance of your PC, but it strikes me as being more for people who like to tinker than for serious PC users. Besides, the default formatting that comes with your disk should be generally optimal (unless somebody back there is not doing his homework).

But, you can change the interleaving of your hard disk—if you have the right kind of hard-disk-formatting program.

A NORTON BENCHMARK TEST I've also been receiving some curious notes from folks who have been using my System Information program on ATs and some other machines as well and getting a

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■ PETER NORTON

very odd result. The SI program includes a brief benchmark of raw computing speed, which it reports relative to a stock PC. A PC gets an index of 1.0, a PC jr about .7, an 8086-based Compaq Deskpro about 1.7, and a Compaq 286 or an AT souped up with a fast crystal about 7.7.

Now my computing index can and will vary from report to report by up to about 15 percent simply because it uses the computer's clock to time how long SI's benchmark computation takes, and the computer's clock "ticks" only 18 times a second. That may seem often, but it's a crude measure of time for the purposes of SI's benchmark. If I make the computation take longer, I could avoid some of this problem, but that would make the process take longer than most folks would care to wait. SI's computing speed index was intended to be nothing more than a crude measure of the computer's speed. Besides, *all* computing benchmarks, including those much more refined than SI, have a lot of baloney in them concerning which kind of computations they are measuring.

While SI is admittedly crude and slightly uneven in the index it reports, it was supposed to be sound. But reports started coming in that the latest version, 3.00, was consistently reporting a lower index on 286-based machines, like the AT, than the previous version. For example, an AT or Deskpro 286 running with the fast 8-MHz clock would get a computing index of 7.7 with Version 3.00 of the program, but an index of 7.0 with Version 3.10. That's only a 10 percent difference—well within the index's margin of error, but it's a consistent difference for ATs that doesn't happen for regular PCs.

It took ingenuity by my team to figure it out. While the actual benchmark test hadn't changed, some slick new features had been added to the other parts of the program. This displaced the locations of the data that the benchmark worked on. So what? we'd say, under normal circumstances. But 286-based computers like the AT fetch data from memory 2 bytes at a time. If a program, like SI, asks for 2 bytes of data from an even memory address, it gets it quite a bit faster than if the data comes from an odd memory address. At the even address, both bytes would be fetched in the same memory cycle; at an

odd address, it would take two separate cycles to put together both bytes.

By accident, data in Version 3.00 of the program fell mostly on even boundaries; in Version 3.10, on odd ones, which slowed

down the computing index. It could easily have been the reverse or no different. Now that we know about the problem, we'll make sure it's handled consistently—but how embarrassing!

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■ JIM SEYMOUR

THE MAGIC OF THE RT PC: LAVISH SPEED AND POWER

Exciting but expensive, the first RTs will most likely be used for engineering or such complex applications as currency trading.

IBM's RT Personal Computer is a genuinely exciting new product. It's a marketing coup—the first useful, affordable, reduced instruction set computer (RISC) to make it to market.

It's a technical coup: packing all that speed and power into a desktop machine is very impressive.

And it's a positioning coup: delivering so much machine for $11,700 (make that about $19,500 or so with a monitor, the RT PC's $3,400 [ouch!] AIX operating system, and an AT-compatibility add-in card and software) must be awfully intimidating to other computer-makers such as Hewlett-Packard, whose highly-touted "spectrum" series of RISC machines has been beaten to market despite HP President John Young's public commitment to a "RISC future" for the company.

The RT PC's a dazzling machine: 2-plus MIPs (millions of instructions per second), a 23-MHz clock speed (though still just 6 MHz on that 80286/AT-compatibility card), up to 3 megabytes of RAM in the desktop model and 4 megabytes in the floor model, more than a trillion bytes of virtual memory, support of the IBM EGA and PGA color standards, plus new high-resolution color and monochrome monitors.

I love the RT PC. I truly do. And yet, I've...

We've got to remember that this is far from a mainstream machine. No one's going to spend four times the (street) price of a comparable PC AT (or five times the price of a good AT clone) to run those same old DOS applications programs.

But so far, there's not much available for the RT PC under its native operating system—that pricey AIX UNIX System V variant.

NOT MUCH OUT THERE At the RT PC's introduction in late January, IBM listed a few packages that were due to be available by the time the RT was scheduled to start shipping at the end of March. In the general-business realm, there's *Solomon III*, probably the best high-level accounting package available for personal computers, and there's *SAMNA+*, a ho-hum word processor that desperately needs the RT PC's speed.

And that's it. No spreadsheets, business graphics programs, mainline word processors, or anything else.

No fair, IBM says: "We didn't intend this as a general-business machine. That's the AT's job. The RT's made for the engineering/scientific/technical community.

And besides, anyone who wants to run general-business applications on the RT can buy the AT-compatibility board and software and run all those existing PC applications."

Sure—but how long do you think business-software developers are going to be able to resist 23 MHz, 3 megabytes of available memory, and a trillion bytes of virtual memory?

Which leads to some interesting speculation about what we may see running on the RT before too long.

FLOOD WARNINGS First, in its own realm, we'll see a flood of engineering and architectural design software ported over to the RT PC. IBM provides a C compiler in that AIX package, and anyone with a CAD package in C running on something else—especially under UNIX System 5 on something else—is in good shape.

At Autodesk, John Walker says they'll have *AutoCAD* on the RT just as soon as they can get their hands on the machine and get to work. Since *AutoCAD* is already in C and running on such UNIX-based engineering workstations as the Sun Microsystems machines, Walker's informal guess of 2 to 3 months for the port sounds possible. You can bet that the P-CAD people, who have almost as strong a lock on the printed-circuit-board CAD market as *AutoCAD* has on the mechanical CAD market, will be on the RT soon, too.

Second, in the business applications universe, look first for high-function programs for managing money. I'm not talking about checkbook balancers for you and

The new IBM RT PC.

■ JIM SEYMOUR

me, but vast, complex programs with substantial doses of artificial intelligence. They'll handle such things as tracking and matching forward positions in foreign-currency trading for multinationals, or assembling multiple-location cashflow reports and updating cash models for corporations.

You can expect to be knocked over by the prices for some of these programs—

—say, $25,000 and up—but the high-ticket work they're handling will make those prices seem like peanuts to the money managers who'll be buying them.

RECOUPING YOUR EXPENSES Just as you and I might gloat over paying for an AT or a Laserjet with one big-hit use of the device, these people can easily recoup $20,000 of hardware and $50,000 of software in just one deal. And you can bet they will.

In a somewhat larger market, we'll certainly see programs to calculate route schedules for trucking operations. Figuring out which stops which drivers should

■ How long can business-software developers resist 23 MHz, 3 megabytes of available memory, and a trillion bytes of virtual memory?

make, in what order, with which packages in which trucks is a phenomenally complex job—yet one with an immediate payoff for any firm operating more than a few trucks in any large city.

Existing programs calculate route sequences and print schedules for drivers, but the recalc speed and number of variables they handle is severely constrained by the performance limitations of AT-class computers.

Put that job on an RT PC and stand back.

That's the key, I think, to understanding how the RT PC will worm its way into business applications: look for applications that are presently constrained by speed, memory size, and storage limitations on ATs.

Then see if speeding up those applications and making them easier to use has a high payback for users. If the answer's yes, you can bet we'll see RT PC/AIX programs for that job. And soon.

■ STEPHEN MANES

GRAPHICS: HEADING OFF THE CHARTS

Manes runs into an old high-school chum who thinks business graphics aren't worth the paper they're printed on but is making a mint selling the software.

The last time, I ran into him at Bowery and Grand, where he attempted to clean my windshield with the remnants of a wine-stained brown bag. Now my old high-school classmate, Deadhead Ed, whose sales career has encompassed everything from dental appliances to canary cages, was emerging from a tony cabaret with a blonde on his arm, a Rolex on his wrist, a Meladandri on his back, and a chauffeured Bentley on the street. Since I was coming out of a pizza joint, I pretended not to notice.

"Hey, Bigmouth!" he hollered.

I'd always been a sucker for my high-school nickname. "You win the lottery, Ed?" I called as I crossed the street. Somehow I couldn't bring myself to use his high-school sobriquet in front of our leading daytime actress.

"Nope," he said magisterially as the soap siren nibbled on his car. "What did it was business graphics."

He handed me a card. His name was superimposed over a trend line with an upslope steeper than that of the north face of the Eiger.

"You know how it is in business, right? Any little thing to give you the edge?"

Obviously I would not have been reduced to eating in that pizza establishment if I knew the slightest thing about business. Or food. "Of course," I said.

"The competition was beating me silly. Every time I got set to close, somebody'd beat my time with a better presentation. Then this computer and 16-pen plotter fell off a truck."

"Or was pushed," I hinted.

BETTER THAN A TOASTER "Bigmouth," he said with a wink, "the computer is the greatest labor-saving device since the toaster. Me and the machine, we were the equal of any big company with a whole graphic arts department. The presentations I created! Pie charts, scatter charts, bar graphs, line graphs. In color yet!"

"And sales picked up?"

"Picked up? My sales trend line looked like the launch of *Voyager 2*."

Miss Procter and Gamble gave him a proud but silent kiss on the cheek.

"What I never realized was how graphics can unleash your creativity. Say you've got a slow-growing product, but you want to give it a boost. You enlarge the scale, show just the top, and the graph looks like Mount Etna."

"Creativity," I said.

"Right! Or you can put meaningless numbers on the sides of the graphs—no numbers at all. Look at some of the sales charts they print in computer magazines. Do the numbers mean some unit price, or some ratio of current price to some other price, or what? Who knows? Who cares? Look here!"

From the greenery in his overstuffed wallet, he dug out a frayed clipping from *The New York Times Magazine*. "This is about a meeting with the chief exec officer of Avon. H.D.S. means home direct selling."

I read: "There is a bit more talk, then it's decided that the chart will be redrawn so that the H.D.S. segment will be shown getting bigger at a slow rate, so people won't think it's shrinking, even if it is. Reality and charts don't always coincide in business."

"In other words," I paraphrased, "business graphics is a creative way of lying."

"Lying? In business? Bite your tongue!" He waggled his golf-ball-sized emerald in my face reprovingly. "It's just a question of putting the best face on the situation. You got a problem, you hide it in one of those stacked bar graphs nobody can ever figure out. Or you invert the axis, so you get a nice rising curve where everything's actually sinking into quicksand."

"But if everybody does this," I asked, "how could it be so powerful for you?"

"Because I stopped using it!"

MY MOST MEMORABLE GRAPHIC I shook my head in utter bewilderment.

"Big, there's a graphics war on. It's so easy to make the damned things, every-

■ **STEPHEN MANES**

body's got 'em. Stop the next five guys you see with sales cases: They'll all have thick books lined with chart after gorgeous chart. Or transparencies and overhead projectors, or even portable computers that run little animated shows."

"Pretty depressing," I admitted.

"And if that isn't bad enough, look inside any big company. People are spending one-third of their time making graphs, one-third showing them, and the other third looking at other people's."

"You could make a pie chart out of that," I pointed out.

"I already did. Now, you tell me. When was the last time you saw an exciting graph—or even a memorable one?"

I couldn't remember.

"When was the last time you saw a graph you trusted enough to accept without seeing the underlying data?"

I thought there might have been a couple back in analytical geometry class.

"And when was the last time you made a decision on the basis of a graph?"

I had bought a tattersall shirt a couple of summers ago.

"Well, there you go. Graphs lie. They

■ **"When was the last time you saw a graph you trusted enough to accept without seeing the underlying data?"**

confuse. They bore. So I dumped 'em. I walk in with no presentation book, no computer, no projector, no nothing. I ask to talk to the right person; I say I won't waste our time with a single slide, chart, overlay, or presentation graphic. I tell them about the product. I make the sale, and I'm gone."

Ed followed this friend into the Bentley. "Everybody's happy. The customer's happy because he gets rid of me in a hurry. I'm happy because I get to make more calls, and I don't have to lose sleep producing all those charts or get musclebound carrying them around. Today, a word is worth a thousand pictures."

"Sounds like you've got it figured," I said with genuine admiration. "What are you selling nowadays, anyhow?"

"A boom product! A fantastic product!" the erstwhile Deadhead enthused as Jeeves revved up the motorcar. "The product of the eighties: business graphics software!"

■ STEWART ALSOP

THE MYTH OF STANDARDIZATION

The so-called DOS standard simplifies the work of hardware and software developers, but it leaves users struggling with a flood of complex, competing, and incompatible products.

Some 4 million or more IBM PCs, XTs, ATs, and compatibles have been sold in the past 4 years, according to most estimates. Forecasters believe that at least 2 million more will be sold this year alone. Most people point to this incredible success as evidence that DOS has become a standard in the personal computer industry.

The industry says that this standardization has enormous benefits for everybody involved. Consumers get virtually unlimited choice in their features or price because companies can develop software, peripherals, even whole computers, to the same specifications. And all customers, either corporation or individual, can design a system that suits their needs exactly. Likewise, vendors can apply their creativity and resources to solving customers' problems or finding more-efficient ways to make the same products, instead of reinventing the same technology over and over again.

Is this what's really happening, or is it just industry propaganda? Probably the latter. What is really happening is mass confusion and rank disappointment for exactly the people who are supposed to benefit most from the standard: the average guy who uses a computer.

Say, for instance, that I want to build a DOS system for writing articles or doing financial analysis (which are the two primary applications of personal computers). That seems easy enough: I just buy a two-floppy disk 256K-byte PC or compatible, a monochrome monitor, a display adapter, a printer, and the program that does what I

want. No problem. If I really want to get the right system, of course, I would have to evaluate more than 200 separate products and about 15 different technologies. But I'll probably just buy what everybody else is buying, and it will probably work.

MERELY TYPEWRITER REPLACE-
MENTS But is having a computer system that can do one thing really the intrinsic value of a personal computer? Have so many people been getting excited about these machines because they replace our typewriters or calculators? Or is there something more that we should expect from these machines?

Say that I would also like to use my computer to organize to-do lists; maintain a contact list of names, phone numbers, and addresses; update a prospect list of a couple of thousand names and addresses; send and receive electronic mail and peruse remote databases; record and summa-

rize expenses; write checks and record business expenses properly for an accountant; and possibly even prepare financial presentations.

All I have so far is a basic PC-compatible with 256K bytes of RAM with monitor and printer. In order to do all the things I listed, I need to boost memory with an add-in card with another 384K and I will also need a hard disk, a modem, and at least five programs, depending on what features are offered by the programs I actually buy. If I was fool enough to want to include graphics with my financial presentations, I would also need a graphics adapter card and a high-resolution monitor.

IS THIS STANDARDIZATION? Each time I buy a new product, I am going to have to decide between as many as 90 possible brands. I am also going to have to make sure that it's compatible with all of the preceding pieces of the system, both hardware and software. If the program I want isn't compatible with the hardware I've got, I'll have to upgrade some of the hardware. And if I really knew what I was doing (which I wouldn't unless I had already owned a computer and used it for at least a year), I would probably want some way to integrate all these activities so that I don't have to keep quitting out to DOS, switching to a new directory, and starting a new application. Is this standardization?

In any case, I will have between 20 and 30 points of compatibility to worry about in building this particular system before I even get to the point of figuring out how to use all of these products efficiently, not to

Illustration: Daniel Aziz

■ STEWART ALSOP

mention in tandem with each other.

Once I've got the pieces of the system hooked together and the software installed on the hard disk, I then have to worry about remembering which application (not to mention its data) is stored in which subdirectory on the hard disk. I have to remember which application uses which command conventions and which keys for saving and retrieving files and for editing content. If I use any programs that are resident in memory, I must make sure not only that I load them into memory in the correct order but also make certain that they don't use the same "hot keys" and don't conflict with each other while in memory. Is this standardization?
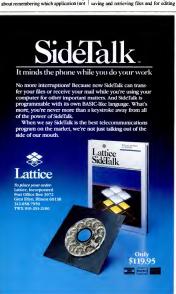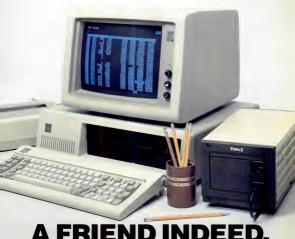
Of course, by the time I get all this figured out, which will either take me about 3 months if I work at it full time or about 2 years if (like everyone else) I still have to live my life and do my job in the same time, a whole new set of standards will have arrived plus a whole bunch of new technology that used to cost $50,000 but will only cost me $1,000. Do you call this standardization?

TOO MANY STANDARDS No, it isn't standardization. In the process of promoting standardization, the industry has lost sight of what it's trying to do for users. We've got so many standards right now that it's no wonder that even well-paid and well-educated professionals like the directors of management information systems for large corporations have had to slow down their companies' purchases to figure out how all this stuff works together. What about poor John Doe sitting at his desk at Wonderful Mutual, thinking what a rotten deal he got with this $3,000 hunk of junk in front of him that has barely managed to replace his typewriter and his calculator?

In its hurry to promote technology, the industry has focused on making big systems work with micro-mainframe connections, local area networks, shared resources, integrated applications, and on and on. But the most valuable thing a personal computer can do is to solve our little day-to-day problems. Most people I know in the industry, who tend to know a lot about computers and how they work, still use Rolodexes, handwritten expense reports and checks, and paper notepads. But the computer can't deliver that kind of benefit when you have to get a screwdriver out every time you want to change a setting on your graphics board, when you have to pull a manual out every time you use a program you only use once a week, or when the plug/power supply for your modem won't fit into a standard four-plex outlet because there's already another, similar plug taking up too much room.

*Some found out the hard way. Many have been spared
for now. If you use IBM's power machine and haven't
yet taken remedial action, it may be just a matter of time.*

PC MAGAZINE

Courting Disaster
The IBM PC AT

If you own an IBM PC AT and your hard disk hasn't
crashed yet, don't worry—it probably will. If the experi-
ences of *PC Magazine*'s editorial staff, the Ziff-Davis
Publishing Co., and a horde of other corporate and pri-
vate AT users we've heard from are any indication, ownership
of IBM's flagship personal computer and its 20-megabyte hard
disk is sure to lead you and your data down the primrose path to

destruction than anything since Nero and
his fiddle.

The crime scene at the AT theater usu-
ally plays something like this: You power
up your AT on some bright sunny morn-
ing, thinking it's going to be just another
normal working day. Clouds darken the
sky when, after the AT's power-on self-
test (POST) routine finishes up, the usual
whining of the floppy disk drive and
whoosh of the hard disk is followed by an
ominous message on your screen, right
about where the memory-check messages
had just appeared.

"Disk Boot Failure," it says.

You inhale deeply, perhaps even gasp,
as you pull down on the big red switch to
shut the machine off and remove the of-
fending message from your life. You
thought you'd escaped, that yours wasn't

one of the thousands of PC ATs with hard
disk problems you had heard about in user
group meetings and read about in *PC Mag-
azine* and other computer and business
journals. Everyone said the hard disk prob-
lem was real, but yours had kept on work-
ing, belying the rumors that the IBM AT
was a seriously flawed machine. But there
it was, serious evidence of a failed hard
disk in your AT. . .or was it just a random
error?

Is the AT's hard disk a serious flaw in
an otherwise solid product? Does the AT
have other hardware problems to contend
with as well? Or is the whole AT horror
story just the wild rantings of scandalmon-
gering journalists? Play out the rest of the
scene, and see for yourself.

You flip the switch to power the AT
back up again, hoping against hope that the

> *E*arly on, IBM denied there was a problem with the drive . . . . They just looked at it and said, 'No, you guys are all wrong. There's nothing wrong with the drive.'
>
> —president of a hard disk manufacturer

message was a random error and that your disk is in good shape after all. The cloud gains a silver lining as the AT's Intel 80286 processor carries it through its POST and the DOS boot routine, loads your device drivers, and runs your AUTOEXEC.BAT program. All systems appear to be go as you boot your favorite spreadsheet, word processor, or whatever it is that keeps you eating your daily bread.

OMINOUS MESSAGES But the nightmare is real, and soon, perhaps not that first day, but sooner than you'd expect, those dark clouds will reappear when you attempt to retrieve or save a file on your AT's hard disk. DOS or your program cannot cooperate; you'll be confronted with:

```
General Failure Reading
Drive C:
```

or, perhaps more ominously,

```
Disk C: Not Ready
Abort, Retry, Ignore?
```

messages cluttering your screen.

It's too bad the ominous messages aren't all there is to it or that there isn't an easy way to recover from what's causing them. The sad truth is that the AT's 20-megabyte hard disk or its disk controller has either started to fail and is taking your data with it piece by piece or has failed completely and will never work again. The data you were trying to work with is probably gone.

If you were trying to retrieve that file, it's lost, or at least most of it is. If you were trying to save it, you might be able to save it onto a floppy disk (if you happen to have a formatted one handy), but DOS may have gone ahead and crashed beyond all recall

by that point. It may not matter much what you try to do because DOS's health is determined by just how far things have gone awry on your AT's hard disk. You may not be able to salvage the file of the moment but there's hope for the rest of the data on your AT's hard disk. When you start up the AT again, things may still look normal. It's actually possible, for example, that the file you were trying to retrieve is still there and in one piece.

Things may look normal for a while, even weeks, but in all likelihood the same symptoms of hard disk problems, or still worse ones, will appear. The worst symptoms crop up when your hard disk is totally gone; no amount of repowering the AT will bring the disk, your data, or sanity back into your life. When that happens, the AT's BIOS programs will no longer recognize the hard disk's presence in the machine and, no, rerunning the Setup program to reassure the AT's nonvolatile configuration RAM of its presence will not fix the problem.

BACK TO BASICS Starting your AT without a bootable floppy disk inserted in drive A: will probably land you in Cassette BASIC, which is, at best, a horrible embarrassment for the owner of IBM's most expensive micro. After all, it doesn't even have a cassette port.

From this point on, whenever you try to run DOS, things may seem OK—the apparently fried hard disk will reappear on occasion and boot the machine normally. But things certainly aren't OK, because your $2,000 IBM disk is gone turkey that has bad data sectors or, worse, bad sectors where the boot record, file allocation table (FAT), DOS system files (IBMBIOS.COM and IBMDOS.COM), or root directory are stored.

After encountering any (or all) of these

symptoms, it's reasonable for you to run the Diagnostics program supplied with the IBM *Guide to Operations* for the PC AT. The hard disk analysis routine in the program will either declare the disk to be healthy or refuse to recognize its existence in your machine. It will probably not detect the bad sectors on the hard disk that are the cause of your problems.

Despite the bad information from Diagnostics, you undoubtedly have bad sectors on your AT's hard disk. Running *The Norton Utilities* Disk Test (DT) program (developed by *PC Magazine* columnist Peter Norton) will inevitably tell you that there are bad clusters (disk sector groups defined by DOS) and where they are. Some of the flawed areas will be occupied by your program or data files (DT can also tell you which files are in trouble), while other clusters will be unused. DT will politely offer to mark unused ones as unusable. That way, DOS will not try to use them for storing new data. If you don't own the Norton program, Charles Petzold's DISKSCAN.COM program found in this issue's hard disk's Programming/Utilities column will tell you about the location of any bad disk sectors.

Unfortunately, there's nothing that *PC Magazine's* best DOS and disk gurus can do for the bad disk areas that contain files except suggest that you try your best to recover the data and hope you have it backed up somewhere else (see this issue's Peter Norton column, "Down with the PC AT, Up with the Compaq 286," for his account of hard disk failure).

It doesn't matter, however, because your disk is gone and, even if you allow

> *I*f you have a bad day, it's no big deal. If IBM has one, it's a shot heard round the world.
>
> —a retail technical representative

DT to mark off the bad spots, more will show up as you continue to use your AT. If you're lucky, your boot record, FAT, DOS system files, and root directory are in good shape and you can recover some or

HOW MUCH IS THAT LOGO IN THE CORNER?

Despite repeated bouts of hard disk terror, executive editor Paul Somerson remains true Blue, a fervent believer in the virtue and value of those three magic letters.

The way a lot of people figure it, this skinny little matte-finish sliver of aluminum goes for upwards of two thousand bucks. After all, you can take home a stripped-down PC's Limited AT and someone's grainy monitor for maybe half what it costs from IBM. To these people, computers are all the same under the skin, just a commodity collection of the same resistors, cables, and chips.

Wrong. If all you're ever going to run is one or two standard, well-behaved applications, and you're the kind of penny-pincher who buys generic cola or washes and reuses paper cups, such work-almost-alikes may fit the bill. But if you ask me, that little square inch of aluminum is worth every inflated cent.

Sure some machines out there come pretty close. AT&T's hardware isn't bad, and I wouldn't turn my nose up too far at a Compaq Deskpro 286. Tandy's boxes have gotten a lot better. You get the feeling these three companies might be around next year. But with IBM there's no question. Something tells me that even if world leaders charcoal-broil the earth's surface, IBM would find a way to weather it.

Really now, if you buy a "Computers 'R' Us" brand AT, will you be very surprised next month with a frantic call to their tech support line gets you is a scratchy recording with the words "we're sorry" at the beginning?

Yes, IBM has pulled some fast ones. Every single AT in our offices has crashed at least once, and I'm working on my own AT hard disk number four. But the silver lining is that it forces me to be absolutely currently backed up. And using my computer now has an extra dimension of terror that is—well—exhilarating, like driving a fast car over a wet Alpine pass. IBM's no-nonsense policy is that it'll take your busted part and hand you a new one overnight. Try that with some other companies. Unfortunately, unless you insist on IBM-only parts, they may hand you someone else's reconditioned CMI drive in exchange for your lemon. So nobody's perfect.

Why else am I true Blue? IBM's keyboard is so vastly superior to the spongy plastic toys foisted off by other manufacturers that it alone is nearly worth the surcharge. The only way competitors are going to siphon off business is to beat IBM's prices by a mile, and that means cutting corners on quality. When it comes to my data I'll spend the few extra dollars. As Somerset Maugham said, "My tastes are simple; I want only the best—and there's precious little of that."

As long as software authors are going to write naughty code that looks directly at hard ROM addresses, I want an IBM ROM that's not going to freeze the program, blink away my data, and send the computer to never-never land. I also spend a good deal of time with BASICA. Not GWBASIC, or some other maxi-miss. Half the stuff readers send in to *PC Magazine's* hack-of-book productivity columns works fine on IBM equipment but blows away even fairly decent clones like Compaq; I shudder to think what it would do to some $498 monstrosity made in Bulgaria.

One of the biggest problems with certain kinds of non-IBM hardware is that you end up with pieces from several different vendors. You buy two things that plug into each other and when it doesn't work, both suppliers give you the old "Sorry, that's not my problem, it's his fault." IBM may have sold some flaky drives, but they're the best one-stop shopping center around.

Don't get me wrong. I'm not wild about IBM speed governors that prevent you from juicing up your AT crystal. Or the Mickey Mouse arrangement of piggy-back RAM chips sold at a fierce premium. Or the overpriced and non-standard floppy drives. Or the strange new AT serial port. And the smoke is still coming out of my ears from my most recent hard disk fiasco. I should have suspected something when it made a noise somewhere between a lawnmower choking on wet crabgrass and a popcorn machine running amok—and then stopped dead in its tracks, so to speak. I'll see the message "General Failure error reading drive C:/ Abort, Retry, Ignore?" ever again, it's too soon.

But when IBM comes out with its 80386 supermicro, am I going to burn the phone lines to my dealer and order the first one he gets, sight unseen? You don't have to ask.—**Paul Somerson**

PC MAGAZINE

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January 29, 1986

Mr. Robb Wilson
IBM Corporation
Entry Systems Division
5201 South Congress
Boca Raton, FL 33432

Dear Robb:

As we discussed, below are the questions we would like IBM to address
regarding the seemingly high percentage of hard disk failures on PC
ATs. For the record, I want to restate that PC Magazine's interest in
this subject is not to fan a dying fire. We realize that IBM has been,
through its dealers, conscientious in correcting PC AT problems. We
do, however, think it's necessary to publish what will hopefully be
the definitive roundup of a largely-misunderstood problem. We want to
set the record straight.

Here are the questions:

1. Are there interactions between the drive and controller that cause
   or exacerbate disk failures? If so, can they be corrected in the
   field or are they too embedded?

2. Were there any software problems in DOS 3.0 or BIOS that caused or
   exacerbated the problem? If so, how have they been corrected?

3. Are there improper procedures in converting from DOS 3.0 to DOS 3.1
   that can cause problems? If so, what are they?

4. Can the original install of the hard disk be done incorrectly so as
   to cause problems later?

5. What percentage of the 20 MB drives in PC ATs have failed?

6. What are the prospects for future failures of those that haven't?

7. What is IBM's warranty policy for CMI drives? Does it extend beyond
   the normal 12-month period?

8. Machines 14 and 15 months old have been serviced under "extended"
   warranty. Who is paying?

9. Are disk failures in any way related to clock speed? Do owners who
   accelerate their ATs with faster crystals run a significant risk of
   accelerating the failure of their hard disks?

Thank you for your cooperation in addressing these concerns.

Sincerely,

Bill Machrone

Bill Machrone
Editor-in-Chief

Editor Bill Machrone expressed PC Magazine's concerns about the AT to IBM in late January. The company's response is on the facing page and is numbered point by point, 1 through 9, to correspond with Machrone's questions.

IBM RESPONDS: A STATEMENT ON PC AT QUALITY

IBM responded to editor Bill Machrone's nine questions (facing page) in this point by point rebuttal. The statement that follows is reprinted verbatim.

IBM has closely monitored the performance of its Personal Computer AT since the product was announced in August 1984. We have listened to our customers in both large and small accounts. We have listened to our dealers and to our sales, service, and distribution network. We have conducted extensive opinion surveys to more fully analyze and understand the customer's level of satisfaction with the AT.

Opinion surveys conducted for IBM indicate that the overwhelming majority of AT owners are satisfied with their machines. Our warranty and repair data support this finding. To be sure, we have received some reports of problems with the machine's fixed disk drive. IBM consistently has acknowledged receiving such reports. We have evaluated those reports and taken whatever corrective action has been required.

To IBM, this is an ongoing process. If a customer is not satisfied with our product, we'd like to know about it. If we determine that a problem exists, we notify customers as soon as possible. For example, when we became aware last year that a limited number of ATs contained a faulty adapter card component, we quickly informed our customers. Customers were provided with a test diskette to help them easily determine whether their machine was affected. As with any other IBM product, our goal then, as it is now, is to ensure customer satisfaction.

1. A close level of interaction between the controller and the fixed disk drive is, of course, necessary for proper system operation.

As you may recall, last summer we notified our distribution/service channels that a faulty component could cause difficulties in less than 10 percent of AT controller cards. As part of last summer's program, we supplied customers with test diskettes to help the customers determine quickly and easily whether their ATs contained the faulty component. If so, the adapter card was replaced.

To answer your immediate question, we are not aware of general or widespread interaction problems between the controller and the fixed disk drive. If a customer should encounter difficulties, we have diagnostic procedures available that can isolate the difficulty to either the controller or the fixed disk drive. These diagnostic procedures can be followed easily in the field.

2. None that we're aware of.

3. No, if customers follow the procedures outlined in the appropriate IBM documentation.

4. Sure—and an incorrect fixed disk drive installation clearly could lead to customer problems. Examples of incorrect installations can include poor cable connections or physical mishandling of the fixed disk drive. It should be emphasized that the fixed disk drive is a sophisticated component that can be damaged through improper handling. Those points aside, we don't believe incorrect installation of the fixed disk drive is a significant or widespread problem.

5. We consider that information to be confidential. However, based on the several customer surveys on the AT that have been conducted for IBM, an overwhelming percentage of AT owners tell us they're satisfied with the system. Our warranty/repair data support that conclusion. As to the small percentage of AT owners who may have encountered a problem, we'd like to know about it so that we may take the necessary corrective action.

6. We anticipate that customer satisfaction with the performance of our AT will continue to be high. Again, the overwhelming majority of AT owners have indicated to us that they are satisfied with the product.

7. IBM's formal warranty for Personal Computer AT products is 1 year. That term has not changed since the product was announced.

8. IBM does not offer an extended warranty on the Personal Computer AT. IBM has various channels that provide customer support, including our authorized resellers, the direct sales divisions and, in certain cases, the manufacturing site. On occasion, out-of-warranty service may be performed by an IBM support organization owing to unusual circumstances or in order to gain additional information regarding machine performance. A recent example of this practice is the AT customer satisfaction program announced last summer, in which IBM replaced faulty adapter cards in a limited number of ATs. This program was conducted at no charge to the customer, even for those machines that were no longer covered under the 12-month IBM warranty period.

9. First, customers should understand there is a risk any time a machine is operated beyond the machine's stated specifications. The AT is not an exception to this rule, and IBM does not support use of the product beyond the test specifications. Further, IBM does not routinely test products beyond the specified limits. Because of this, it is difficult for IBM to state conclusively that a problem may or may not exist beyond the test specifications. In terms of general engineering guidelines, however, we have no evidence that an altered clock speed will lead to problems with the fixed disk drive. We have consistently maintained, however, that altering the machine's speed may, generally speaking, yield unreliable results, and we stand by that statement. ∎

> *"And while the failure rate has gone down considerably in the last 6 months, any time that an AT goes out the door, its chances of coming back are greater than for any other machine. Compaqs are a lot more reliable."*

marketing rep. for a retail chain

all of your data by copying it to floppy disks (use COPY instead of BACKUP to avoid spending an inordinate number of hours telling BACKUP to ignore bad data sectors).

You may not be so lucky, however, especially if you got the "Drive Not Ready" message, or you landed in BASIC, or Diagnostics refused to recognize the presence of the hard disk. If you did, you've got instant disaster on your hands because there is almost no hope of retrieving any of the data from your hard disk.

D.O.A. When you take the AT back to your authorized IBM dealer (and I strongly recommend you do), the IBM-supplied Advanced Diagnostics program used by the technicians there will agree with DT's or DISKSCAN.COM's analysis and declare those disk areas (Advanced Diagnostics works in cylinders and tracks) to be unusable for storing data.

When the AT first came out, dealers recommended reformatting a troubled hard disk using the Advanced Diagnostics formatting program. That way, bad sectors would be correctly marked off and the disk theoretically restored to normal service, albeit with less usable space. They no longer do so because dealers have found that a reformatted disk usually returns to the shop within a week or two with even more bad sectors. In any case, if the bad areas are the ones reserved for the boot record, FAT, DOS system files, or root directory, it's all over no matter what Advanced Diagnostics tries to do.

Your dealer will replace your AT's

hard disk with a new one supplied by IBM unless you request something else. The official warranty period for the AT and its disk is 1 year from the purchase date, but IBM seems to have an informal policy of replacing failed hard disks that are older than that free of charge. A different model disk will cost you. If you want to know what the alternatives are, check out contributing editor Winn L. Rosch's cover story sidebar, "IBM AT Hard Disk Difficulties and Alternatives." He tells you which compatible disks you can use to upgrade an Entry Model AT, or replace the CMI drive you already have in your Enhanced AT.

THE FACTS, MA'AM If you think I'm guessing about what happens when an AT hard disk fails or making up horror stories you can use to prevent sleeping sickness, think again. The scenarios described here are based on the combined experiences of *PC Magazine's* editorial staff and those of the upper echelon of officers and staffers at the Ziff-Davis Publishing Co.

Let's start with the 2-day period a few weeks ago when four AT hard disks went

belly up here at PC Magazine. First it was the hard disk in editor Bill Machrone's machine, which had operated flawlessly for 13 months. "The disk had worked for so long I had become almost cocky about it," he said. "When it failed, I tried everything around to save the data, but sectors kept dropping out faster than I could copy the data on them. Files were there that I'll just never see again."

Then it was new-products editor David Obregón's AT. "!#@$?!" he cried, "there goes the database." In this case, it was *PC Magazine's* invaluable product and vendor-profile database, which was fortunately well backed up.

Executive editor Paul Somerson had the worst happen in both his public and private lives the next day. In the morning it was the hard disk on his AT at *PC Magazine's* editorial offices. "Oh well," he philosophized as he twisted long needles into the heart of a voodoo doll dressed in a tiny white shirt and blue suit. "I have copies of everything safely tucked away on my hard disk at home." Or so he thought. He called me close to midnight, the words cold and leaden. "Dickinson, how are you at reconstructing AT hard disk FATs," he choked out between tightly clenched teeth. "From scratch?"

It had seemed incomprehensible to him that both his AT hard disks could go south the same day, especially since he treated his home machine as gingerly as if small,

PC Labs began looking like a typical automobile graveyard as our AT hard disks chewed up data and system boards failed at an alarming rate.

fragile bottles of nitroglycerin were mounted on the motherboard. The guy would practically park the mask each time he snapped a diskette door shut. "Can't be too careful."

Unfortunately, he wasn't. "I never used to set VERIFY to on," Somerson lamented. "It slowed DOS's copying process down too much." His only real backtems Division in Boca Raton, Florida. When the local ComputerLand technician installed the disk, IBM requested that he replace every removable IBM-supplied part in my AT, including the power supply. The company also insisted I install one of the earliest copies of DOS 3.1. IBM wanted to be sure of something but never told me what. After 6 months of light use,

that disk is still working, but most of my data resides on Iomega Bernoulli Box disks because I trust them a great deal more than the zero-defect hard drive supplied by IBM.

ups were on flaky high-density floppies, and many of his files failed to copy properly. These days he copies in triplicate, and now that his dealer replaced the CMI hard disk with one made by IBM, things are pretty much back to normal—except that IBM's hard disk is not exactly the quietest one on the market. Or, to paraphrase the way Somerson puts it, "The thing sounds like a lawn mower with bad bearings choking on wet crabgrass."

Even as I sat at my AT writing this article, contributing editor M. David Stone called. Our "gentle giant" sounded a mite bitter as he told me that three files on his AT's hard disk had just turned to dust. He had, it seems, been planning a short piece for this issue on how rock-solid his year-old AT has been.

That's not to mention the AT that operates *PC Magazine*'s Interactive Reader Service (IRS). Two brand-new ATs lost their hard disks in 2 days (and you thought we just took it off-line to annoy you). Then there was editorial vice president Jonathan Lazarus's AT, along with others scattered throughout Ziff-Davis headquarters in New York. All of their hard disks have failed in the past 6 months.

By the time you read "The AT's Slipped Disk" in *PC Magazine* (Volume 4 Number 13), the AT I have at home had chewed up four hard disk drives. It ate one more after that. The last one installed was delivered with zero defects (that's very unusual for a hard disk) because it was handselected by engineers at IBM's Entry Sys-

WIDESPREAD DISASTER At Ziff-Davis we are, it turns out, but a microcosm of hard disk disasters among AT users. Other reports from around the country are just as troublesome and associate editor Charles Bermant and senior editor Bill Howard have compiled several of them in "From Sea to Shining Sea."

The AT's 20-megabyte hard disk is only the biggest and most widely heralded problem with the AT. Manufactured by Computer Memories Inc. (CMI) under contract (until recently) by IBM, the disk has self-destructed in a large number of ATs, but that's not all that's wrong with the computer. The AT's disk-controller card, which is made for IBM by Western Digital Corp., was found to have a faulty logic chip, and IBM issued a special diagnostic program and field repair order to locate and correct the problem. Also, the cables connecting the disk drive to the controller have been plagued by faulty connectors that tend to slip apart and may cause hard disk crashes or at least unreliable operation.

NO COMMENT We tried to interview engineers at CMI and Western Digital, but no one is answering the phones, at least not if you're in the computer magazine business. But senior editor Bill Howard found a

Stone on Long Island, New York. Stone, a value-added reseller, is holding a barrelful of faulty CMI hard disks.

That's just hard-disk-related problems with the AT. Many users have also suffered from faulty motherboards that fail suddenly, often taking hours or days of work with them. Two AT motherboards failed at *PC Magazine* recently, including the one in Somerson's machine (poor guy, it happened the day he got the CMI disk replaced). Machvine wrote to IBM concerning "the high percentage of hard disk failures on PC ATs." His letter is reprinted here, next to "IBM Responds: A Statement on PC AT Quality." If you want to stay away from Big Blue but still have the power of an AT on your desk, take a look at editorial assistant Christina Dyar's compilation of AT alternatives that we have previously reviewed in "Power Computing: Alternatives to the IBM AT."

IBM's PC AT has set the standard for powerhouse personal computers. But its flagship PC has undisputable hardware problems that have taken millions of megabytes of data, along with countless frustrating hours of user and technician time, with them into the proverbial bit bucket.

The biggest problem of all is IBM itself and its attitude toward both the flawed machines and the unsuspecting customers who have bought them. IBM refuses to acknowledge that the AT has any hardware problems at all other than the logic chip problems on the disk controller. The company's standard line is that "the failure rates of the AT and the CMI disk drive are not above normal expectations."

Those words have an exceedingly hollow ring to AT owners and users whose work has gone up in a cloud of broken bits.

Dealers, distributors, and users across the country report AT problems, suspect several causes, and see some evidence of improvement.

From Sea to Shining Sea . . .

How serious are the maladies befalling the IBM PC AT? Since IBM considers the failure rate of the components a proprietary—not to mention embarrassing—matter, it wouldn't tell us, and so *PC Magazine* took a different tack to find out. We talked with major computer stores, value-added resellers, corporate buyers, and users for an indication of the scope of the problem.

The reports that came back from interviews across the country indicated that the most prevalent problems, in descending order of significance, are with the AT's 20-megabyte CMI hard disk drive, the Western Digital controller board, and possibly with a combination of the two in the same machine.

Our reports show that no one managed to match *PC Magazine*'s 240 percent failure rate for hard disk drives: among the five ATs in-house or used by editors at home, a total of 12 dead drives including replacements. One reseller found a 60 percent failure rate on one shipment of 50 CMI drives. Many reported failure rates considerably lower, but high enough to be of concern. Some reported minimal problems. Several dealers observe that problems were worse in the AT's earlier

days and that IBM was responsive to the problem, quick to honor warranty claims.

Sensitivity to IBM's size and clout led a number of dealers and suppliers to share private concerns about the AT's reliability but to go on the record with "no comment." No one suggested pressure as the reason for silence, merely allegiance to the cardinal rule, Don't bite the hand that feeds you.

THE BIGGEST FRAUD After *PC Magazine*'s experience, the hardest luck story belonged to Al Stone, a principal in the computer services division of a Long Island, New York, company that distributes computer components to dealers and original equipment manufacturers, including hard disk drives for owners of

unenhanced PC ATs in the greater New York area.

"I believe that the CMI drives are one of the biggest frauds ever perpetrated on the American public," Stone says.

"Computers are a business and a hobby for me. I've been president of the Long Island Computer Association, and

statistics on AT failure rates. Businessland even recommends the CMI, along with disks from Tandon and Seagate, as an add-on hard disk for the PC and the XT. And one leading subsystem manufacturer is currently leaning toward installing CMI disks in its units.

Al Harding, who owns Computer Land stores in Santa Fe, New Mexico, and Lubbock, Texas, estimates that the AT originally had a 20-percent failure rate but says the rate has improved in the last few months. His strategy hasn't changed, however: "We had a lot of breakdowns, so we started putting in our own non-CMI disks," says Harding. "We put in disks with 40 and 70 megabytes. It gave us a better profit margin and gave the customer more horsepower. Now that the machines work better, we haven't switched back."

"The failure rate used to be a lot worse," says Mark Mitcham, senior marketing representative for Businessland in Albuquerque, New Mexico. "The number of pure IBM systems we sold is almost nil. We built most of them up ourselves. And while the failure rate has gone down considerably in the last 6 months, any time that an AT goes out the door, its chances of coming back are greater than for any other machine. Computers are a lot more reliable."

An Entre salesman says the AT fails "no more and no less than any other IBM product."

Many dealers commented; some didn't want to be identified beyond their hometowns. Richard Bell of Seattle says, "The AT failure rate is less than 10 percent. For a while it was higher, 15 percent . . . . IBM has now corrected the problem."

Gary Nielsen of Phoenix, Arizona, puts it this way: "The problem with the controller

card was a manufacturing defect. On the IBM AT hard disk, initially we had a lot of problems. Now they're going away, although the AT disks seem to be a little bit more fragile than normal hard disks." Comments a dealer in San Mateo, California, "We don't keep percentages; . . . when there's a failure, most of the time it's disks or disk controllers." And another in San Jose, California, says, "The ATs that we're seeing right now have cleaned up their act. The failure rate now is about the same as with PCs—not significant. When we first had them, the failure rate was about 50 percent. If anything does go wrong, it's usually the controller card."

CONTROLLER'S FAULT? Joe Castoro, a seller of medical vertical-market systems in Coram, New York, says, "In my opinion, CMI did not make the best piece of apparatus, but the major problem with ATs lies with the controller, either in timing or data separation. You can't find an accurate place to lay the blame. It's partly with IBM and partly with CMI. If IBM's controller were more reliable, you wouldn't have such problems with the disk.

"Even with a lower-end hard drive," Castoro says, "the controller can make up for a lot of sins. It can recover from read errors. With the AT, there were a lot of nonrecoverable errors. A good controller can make a lower-end disk—CMI's or anyone else's—less of a problem."

Castoro says he is shying away from using ATs in any configuration unless the customer insists. He prefers to use a PC, PC-XT, or PC-compatible with an accelerator card to match the speed of an AT. If a customer needs an AT-compatible, Castoro recommends using a Sperry: "It's faster and more reliable; . . . there

I saw the opportunity to be a major supplier of CMI drives in the Northeast as a chance to grab the brass ring. I was hurt by this. A lot of little guys were hurt very badly.

"In one 50-unit order of 20-megabyte CMI drives," he laments, "I had 30 defective or dead on arrival.

"I don't think the problem has anything to do with the disk controller. I've seen CMI drives fail on Xebec and DTC controllers, too. They fail just as readily in an XT as in an AT," Stone says. "The CMI exhibits a lot of temperature sensitivity. If you format the drive when it's cold and then write and read when it's warm, it's a fact you're going to get lost clusters."

Some of Stone's evidence is circumstantial. For instance, he says, "We were supplying drives to Novell for use in a large networking system. There were problems that Novell couldn't solve; it thought it had software bugs. We switched to another brand of drive and the problem went away."

USED TO BE A LOT WORSE None of the larger computer chains—Businessland, Entre, ComputerLand, or Sears Business Centers—says it keeps hard

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>
> marketing rep., retailer

THAT SINKING FEELING

Core International's outspoken president, Hal Prewitt, makes good on his promise to give AT drives a burial at sea—and takes IBM to task.

Boaters and fishermen off the coast of Florida should update their charts to indicate a new navigation hazard: CMI Reef. In late February, a crew of Core International workers steamed into the Atlantic with a cargo of crashed Computer Memories Inc. (CMI) hard disks. A mile east of Boca Raton ("in plain sight of IBM's sales offices," notes 31-year-old Core president Hal Prewitt), the boat, a 46-foot fishing craft aptly named the *Megabyte*, hove to. Prewitt reached down, hefted an original IBM-issue AT hard disk from a gleaming pile in the middle of the deck, and tossed it into the drink. It made a frail glugging sound, sort of like an IBM executive swallowing hard.

Prewitt's shipmates pitched in, flinging the dense metal canisters over the rail. After many minutes, the pace slowed to a crawl. It's hard work, throwing disk drives in the ocean.

The sea floor is not normally the home of so many high-capacity, 40-millisecond hard files, especially when they're chock full of data. Archaeologists from the 30th century will have a field day exploring this site. Until then, the hardware will, in the words of Mario Puzo, sleep with the fishes. This was certainly in the back of Prewitt's mind when he devised the stunt. Why does someone throw a million bucks' worth of computer parts

overboard? "Because we guess they're good for fishing," he says wryly as another CMI splashes into the sea. "We already know they're not good for computer data."

"CMI Reef" might provide a better home for fish than these drives did for data.

For 3 months in late 1985, Core ran full-page ads slugged "The Great Recall" in every PC-oriented magazine. "Boca Raton, home of the IBM PC, needs a fishing and diving reef, too," the copy smirked. "Help us build the world's first low-technology artificial reef." The deal was that if you bought one of Core's 40-megabyte hard drives (for $2,595), then plucked your original 20-megabyte drive from the AT chassis and shipped it back to Core's Boca Raton plant, the company would mail you a check for $1,000. And it would deep-six the CMIs that were returned, "simply because that's where they belong."

Well, the ad didn't exactly name CMI in black and white. But Prewitt doesn't pull any punches when you ask him in

person. "It's generally our feeling that it was just a bad drive. It's unfortunate that it was ever sold. I would never recommend that anybody ever use that drive in their computer system, and if they can get rid of it, they should take the time and do so."

The way he sees it, "The drive simply exceeded its overall design capabilities. It tried to get too much out of too little." Instead of dedicating an entire hard disk platter surface as an electronic road map for the heads, CMI's wedge-servo technique cut corners by packing small bits of positional information in with the data itself, according to Prewitt. Rather than use a fast, accurate voice-coil to move the heads, CMI relied on yesterday's clunky stepper-motor technology and an optical feedback device that could be easily thrown off by contamination inside the drive "like a hand in front of your eyes." Unfortunately, the contamination was usually in the form of little pieces of your data floating on oxide dust kicked up when the heads plowed tiny furrows into the surface. This happened all too often, since the CMI drive didn't automatically retract the heads when the power turned off; instead they would drop down and sometimes take a bite out of whatever data they happened to be hovering above. Prewitt says he considers automatic head parking and locking to be

("That Sinking Feeling" continued)

"the single most important feature a disk drive should have in a small business-computer system."

Although Prewitt is one of the largest authorized IBM dealers in the Southeast, he thinks IBM "has made a lot of mistakes. There's no question about that. . . . For the first time users are willing not to buy a 100 percent IBM system after getting burned so badly. Today all computers are created equal. . . . What you should really look for is knowledge and experience and quality. That's what made IBM famous. That's what made IBM successful. They delivered one-stop

shopping, the total solution. IBM has gotten away from that. They now concentrate on being the low-cost volume producer—and you don't see the word quality in there.

"They've done a lot of things that are very nice," Prewitt is quick to admit. "The general design of the machine is one of a very good, well-thought-out architecture. But if you're not a computer expert yourself, you have to depend on somebody for information. And unfortunately you can't get that from IBM these days. The company has never been structured to handle that on the small-end marketplace. You could get it if you had a

million-dollar computer, but you don't get it if you are buying PCs."

Back when IBM was designing the AT, says Prewitt, CMI was making the only 40-millisecond drive available at an extremely good price. "The closest competitor was at least double the cost, so they really had no competition." And, anyway, as Prewitt reminds us, "you gotta remember the IBM/CMI connection. IBM owns part of CMI. Intel owns part of CMI."

These days IBM is manufacturing its own 20-megabyte AT drive in its Rochester, Minnesota, plant, with voice-coil technology, heads that retract automati-

"ADMITTEDLY, THERE WERE SOME PROBLEMS"

A spokesman for CMI says the small company was overwhelmed by the IBM order and has now corrected the production problem.

Was the reputation of Computer Memories Inc. unfairly blackened by l'affaire IBM? Yes, says at least one observer—CMI itself.

"An unfair number of complaints related to the integrity of the IBM system were laid at the doorstep of the CMI disk drive," says John Trifari, a spokesman for the Chatsworth, California, company. "When you get an error message on-screen, it doesn't say there's a controller problem or a computer problem—it says there's a disk problem.

"Admittedly, there were some problems when the company started up. This was a small company that had a finite production capability and it was called upon to deliver very large quantities of disk drives," he says. CMI almost tripled in size in 1985, primarily because of the IBM contract, according to Trifari. It went from a $47-million-a-year company in the fiscal year ended March 1984 to one whose peak revenue was $50 million in the second quarter of 1985.

IBM contracted with CMI for 240,000 model 6426 two-platter, four-

head, 5¼-inch, 20-megabyte disk drives through the end of 1985, Trifari says, and ordered an additional 8,000 in October 1985 (an indication that IBM wasn't unhappy with CMI's product). That order accounted for 60 percent of CMI's business during the course of the contract.

According to Trifari, the problem with CMI drives was a linkage to the read/write heads that came unaligned in shipment, causing the drive to go off track. CMI strengthened the linkage and developed a "drive electronics reporting position" facility to help the read/write heads find track 0 regardless of linkage problems.

"That problem was corrected," Trifari says. "We feel the problems have been resolved that related to the drive."

CMI actually had one other problem with the drive—patent litigation over its design. In an out-of-court settlement with Quantum Corp., CMI has agreed to stop making the troubled 6000 series (20.9-, 31.5-, and 41.9-megabyte drives) as of the end of April 1986. (CMI will then make only a new 7000 series of 53- and 85-megabyte drives.)

Until recently, anyone who bought a PC AT with an official IBM 20-megabyte hard disk got a CMI 6426 drive. Some ATs still in stock contain CMI drives. The 6000 series drives were, and are, also sold to distributors and mail-order houses.

CMI notes that IBM violated its own rule when it chose CMI to make the drives: Never use a single source for components. "So, when there were difficulties with the system," Trifari says, "IBM was forced to put the [hard disk] AT on severe allocation."

Until the AT came along, Trifari says, "The industry was essentially 10-megabyte, 85-millisecond [access time] drives, stepper-motor driven, the type in the XT. All of a sudden, there was a tremendous demand for high-capacity, 40-millisecond drives that were available only in limited quantity from a few suppliers. Any company called upon to make drives in those quantities might have had problems.

"CMI really deserves a pat on the back for the way it pulled it out," Trifari says. "The drives really work well now."—**Bill Howard**

cally, and a dedicated servo positioning surface. But if your current CMI drive goes south, don't expect an IBM-made upgrade, cautions Prewitt. "All they're doing is putting the same drives back in. If you get lucky, maybe they'll put in the Rochester drive, but there's a good possibility you'll just get a refurbished CMI drive, or the other standard IBM drives that have had problems too. Actually, IBM's drive has been in existence for quite some time. It's just that it took quite a while to work all the kinks out of it."

SHARING THE BLAME Prewitt is so sure CMI disks will fail that one of his favorite slogans is "Not If But When." Still, while most critics acknowledge that ATs are not exactly the most problem-free computers IBM has ever stamped out, the blame is often spread around the industry. Nervous AT component suppliers point their fingers in lots of directions. Some claim the controller is the real culprit, or the power supply, or DOS, or, if they run out of villains, the users themselves. "They're kicking the machines. Dropping them."

The hard disk controller was indeed buggy, says Prewitt. It had to do with a chip—a PAL, I believe—that had a floating circuit and under certain conditions could cause some erroneous information to be transferred to the drive. But we were never able to document a single failure absolutely caused by that chip and that controller. However, IBM certainly did the right thing by having the controller card recalled and replaced. We didn't feel it was the major problem. It was also relatively inexpensive for them to replace the controller card compared to recalling and giving you a different disk drive. We believe the reason they didn't do it with the drive is simply the cost."

What especially irked Prewitt was the way IBM handled the problem. "Early on IBM denied there was a problem in the drive. . . . They just looked at it and said, 'No, you guys are all wrong, there's nothing wrong with the drive.' And then when they realized there *was* a problem and stopped the AT production line in January, their comment was, 'Well, you

can't get enough ATs because there's a shortage of disk drives from our primary supplier.' The one thing they left out of the January statement was that they couldn't get enough drives that *worked* in the ATs.'"

But while no Big Blue representative has yet gone on the record and admitted the problem, Prewitt's internal IBM contacts have told him a different story. "I have never spoken to an IBM technician or engineer in Boca . . . who denied there was a problem with the drives. They did tell me there was a problem, that they were working at it hard, and that they were going to fix it. They really stepped up a tremendous amount of testing. They had CMI open a repair facility here, and at one time there were literally tens of thousands of disk drives that IBM had rejected that had to be totally remanufactured for a lot of reasons. If you open your AT and you have a CMI drive in it, you'll notice it typically has a green and a red dot on the front. Some have multiple red dots. Those color codes identify the amount of failures that the drives experienced in internal testing."

The defective CMI drives piled up quickly. "After IBM realized there was a problem, they tried to screen out drives that had a high probability of failing," reported Prewitt. "I would generally guess that it wouldn't have been uncommon to experience a failure rate well into the 95 percent area. Actually, for most manufacturers, it's not unusual to have a failure rejection rate of anywhere from 15 to 30 percent, or even 50 or 75 percent from time to time." Still, 19 duds out of 20 doesn't seem like anyone's idea of high-quality merchandise.

Prewitt says part of the problem is that users don't understand that high-performance disk drives are complex, high-strung devices requiring extensive diagnostic testing. "If you buy a drive directly from a manufacturer or from a

mail-order house that's just supplied directly from a manufacturer, there's at least a 20 percent chance it will fail, or not work, within the first 90 days. Many vendors do no testing whatsoever on the

> **"** *Today all computers are created equal—it's a commodity market. What you should really look for is knowledge and experience and quality.* **"**
>
> **president of a hard disk manufacturer**

drives. They simply treat them like other circuit boards or monitors."

While Prewitt originally hoped that he'd end up with "thousands" of returned drives, fewer than a thousand actually made it over the side. Interestingly, when the promotion was in full swing (it ended in January of this year), he was contacted by "just about every disk drive repair house in the country, wanting to purchase the broken CMI drives. They get thousands of them in for repairs and they desperately needed the parts to try to repair the broken drives."

Core's future plans include releasing its drives for machines made by AT&T, Hewlett-Packard, Compaq, and others. Prewitt also expects to announce a half-height 40- or 50-megabyte, 26-millisecond drive. And he told *PC Magazine* "not to be surprised" to see a high-performance Core controller with an interleaf factor of 1, which would speed up the operation of any hard disk. He had planned and announced a Core-labeled AT called the Atomizer but put its production on hold "due to conditions in the marketplace." However, Prewitt may eventually go ahead and release it later this year. He has his hands full cranking out replacements for aggrieved AT hard disk crash victims. Or, as he likes to put it, "We've become the IBM of the disk drive market."—**Paul Somerson**

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>
> *a dealer*

cloud in the background."

Joe Jaworski, president of Peripheral Concepts, an Irvine, California, independent market-research firm, says the AT problems were traced to some circuit design systems in the controller board that resulted in data separation, along with a faulty TI gate array.

"There were no specific technical problems with the [CMI] disk that I know of," says Jaworski. "It was just responding to erroneous signals."

But, Jaworski says, "when a company does one level of business and a customer comes along and increases its order by 100 percent or more, there will be problems." When problems developed, IBM gave CMI "a ton of money" to clean up quality control and improve efficiencies.

"This market is really dynamic," he says. "There have been more screwups by other companies that have survived." Or as Shearson Lehman Brothers said in an investment advisory, "We would be inclined to look at companies with more clearly defined futures."

Ed Marinaro, executive vice president of Western Digital, says his company "has never publicly acknowledged" that its products are in the IBM PC AT. Asked about the AT-compatible controller cards Western Digital manufactures, which anyone—IBM or an individual—could put in an AT, Marinaro says, "This class of product has been extremely reliable, with one of the lowest failure rates that we have ever seen, about .003 percent."

How did word get out that Western Digital supplies the controller for the AT? "People opened up the machine and recognized our chips," Marinaro says. "But we won't acknowledge being with any specific customer. We respect our customers' privacy and their security."

Both Western Digital and CMI have their names or initials on the circuit boards, chips, or drive casings for easy identification.

LOOK INSIDE BEFORE BUYING

Consultant Dan Sanguinetti, president and CEO of PC Professionals in San Francisco, says he won't touch an AT with a CMI disk. He believes anyone buying an enhanced 20-megabyte AT from IBM should open it up and look inside, only accepting the machine if it has a drive from IBM or Seagate. (CMI only sold 20-megabyte drives to IBM; the 30-megabyte drives are made in-house by IBM or by one other maker, not CMI.)

Sanguinetti blames dealers for much of the AT confusion. When the problem first became apparent, he says, IBM sent dealers a controller-card diagnostic program with instructions to contact all customers who bought ATs. Some dealers didn't bother, causing some AT owners to think they had a disk problem. "If people weren't serviced, it was the dealer's fault, not IBM's," Sanguinetti says.

Sanguinetti says IBM was quick to replace bad disks. "If it's an IBM-installed CMI, it gets replaced quickly. If it's a disk bought directly from CMI and installed by the user or dealer, then it takes a month and a half."

Overall, Sanguinetti estimates a 35 percent failure rate for ATs with a CMI disk.

IBM: COOPERATIVE Bruce Grant, director of technical support for Microage computer stores, says IBM was cooperative in handling the disk problem. "The whole processing time was longer than we wanted, but in retrospect, we applaud IBM's handling. The company said we blew it and corrected the problems. Other than the hard disk, problems with the AT have been minimal.

"You can say that this kind of thing shouldn't happen because IBM is so big," says Grant. "But I can see the other side of the coin. With any other manufacturer, this would be normal operating procedure. It was a royal hassle at the time, but IBM made good. Not every company is like Hewlett-Packard, with a zero failure rate."

Grant calls the AT problems a textbook case of demand pulling down production. There was such a market for the AT that the quality-control mechanism broke down. "For a smaller vendor, something like this is routine. With IBM, it turned into a crisis of major proportions," he says. "If you or I have a bad day, it's no big deal. If IBM has one, it's a shot heard round the world."

A technical executive for a company that supplies components to IBM says buyers of non-IBM AT-compatibles, especially bargain units from the Far East or those sold through mail order, may be-

> **"I** believe that the CMI
> drives are one of the biggest frauds
> ever perpetrated
> on the American public.**"**
>
> *a distributor*

gin to experience some of the AT's disk/controller problems. The cause? Using components with marginal tolerances. "When these machines have some of the length of service in the field the AT has, you're going to see the same breakdowns, possibly worse," he says. As for the AT's problems, he says his company believed weaknesses in the CMI drive

and Western Digital controller amplified each other—but that ultimately the failure was IBM's because customers buy an IBM machine regardless of where the components originate.

> "*The general design of the PC AT is one of very good, well-thought-out architecture. But if you're not a computer expert yourself, you have to depend on somebody for information. And unfortunately you can't get that from IBM these days.*"
>
> president of a hard disk manufacturer

Richard Brown, president of Express Systems in Schaumburg, Illinois, who is involved in direct sales, calls the AT problems "old news." Brown made arrangements with Control Data for what he called "gold-plated drives" to protect his customers.

Jim Stevenson, president of Strategic Planning Corp. in San Diego, says his AT had a bad file allocation table and that reformatting at a lower level solved the problem. (*PC Magazine*'s experience has been that reformatting may only postpone the day of reckoning.)

GENERALLY RELIABLE Robert J. Rush, vice president of the New York Life Insurance Co. in New York City, says his company has 510 IBM personal computers, 163 of which are ATs. He calls the ATs generally reliable, although the company had some minor problems initially. Not including these setbacks, Rush reports less than one service call per year for each machine. "We've had certain electrical and mechanical problems," says Rush. "But this kind of thing only affects business when you're out of business, and that hasn't happened here."

Some mail-order suppliers who sell

CMI drives swear by them, not at them.

Doug Sharpe, manager of technical support for Qubie, notes that the drives were built to IBM's exact specifications, so it wasn't CMI's fault that the units weren't compatible with the rest of the machine. Qubie uses the CMI drive and likes it a lot.

John Hoover, national sales representative for PC Source, a mail-order house, sells the CMI drive as a straight AT update. They sell well, and the company offers a 1-year warranty. Hoover feels the AT's problem stems from a lack of disk compatibility with DOS 3.0. The drive itself works well; he blames the controller card.

"IBM DIDN'T FESS UP" Lynn Wilson, a programmer for Electronic Data Systems in Albuquerque, bought the original AT and had what he describes as "the classic hard-disk problem." He says, "IBM didn't fess up that there was a problem. When you're having problems with this, you don't know if what's wrong with your machine is *the* problem or something else."

Wilson's machine also had a bad motherboard component. IBM wanted $300 for the repair; Wilson, who has an M.S. in electrical engineering, instead took a wiring gate and made his own part. Such homebrewed solutions are not part of the average user's arsenal, and the question is, why should they be?

"No one would tell me anything. I had two choices: panic or wait around. This attitude bothered me more than having the hardware fail," Wilson says.

"STILL A SAFE BET" Is IBM in trouble over the AT? Perhaps, but only in the short term. Kip Myers, vice president of marketing for Plexus Computers of San Jose, California, says, "The average person is trying to cover his ass when making a purchase, and IBM is still a safe bet."

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PERSONAL COMPUTERS

BECAUSE TIME IS THE ULTIMATE BOTTOM LINE.

In past issues, PC Magazine has tested and reviewed ten AT alternatives, many of which outperform the AT. These summaries give you a quick review of your non-IBM options.

Power Computing

Alternatives to The IBM PC AT

I f you want to get into the fast lane of personal computing, IBM's PC AT is no longer the only, or necessarily the best, way to get there. Foreign and domestic computer manufacturers, recognizing that the improved 80286 chip has ushered in new performance standards, are producing speedy, heavy-duty machines that meet or beat IBM PC AT specifications and capability, often at attractive prices.

Not every alternative to the AT is necessarily an AT clone or compatible, but all offer 6- or 8-MHz clock speeds, faster-than-XT processing speed, and plenty of memory and storage. Here's a rundown of all the AT alternatives that *PC Magazine* has reviewed in the last year and a half. As long as manufacturers continue to produce new high-performance machines, *PC Magazine* will continue to write about them and benchmark their performance. Watch for more AT-alternative reviews in upcoming issues.

AT&T 6300 PLUS ("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) Offering a high-resolution tilt-and-swivel monitor, a tiny footprint, and a comfortable IBM-style keyboard with LED indicators, the AT&T 6300 PLUS shares the good looks and ergonomic consideration of its cousin, the AT&T PC 6300. But with an 80286 microprocessor, it's packed with power.

The 6300 PLUS comes with 512K bytes of RAM, a parallel and a serial port, and room for two half-height devices. You have your choice between two floppies (either 360K or 1.2 megabytes) or a 20 megabyte hard disk and one floppy. Two additional half-heights can be housed in an optional expansion box. Of the six available expansion slots, three have the extended 16-bit connector. Although the AT&T 6300 PLUS's Seagate 20-megabyte hard disk rated slower in access time on the PC

IBM AT HARD DISK DIFFICULTIES AND ALTERNATIVES

Winn L. Rosch explains what's wrong with the CMI drive and suggests some alternatives.

Of all the shortcomings of the IBM AT, only one is genuinely lethal to both your data and your mental health—the unbelievably fragile hard disk that IBM stuffed (and sometimes still stuffs) into its enhanced 20-megabyte PC AT models.

Made by Computer Memories Inc., the AT hard disk is an innovative design called "wedge servo" that gives the extremely fast access times normally earned with a servo/voice-coil mechanism (under 40 milliseconds) at a lower price, comparable to that of slower, cheaper band-stepper-motor technology.

The primary problems with the CMI hard disk apparently are caused not by its innovative technology but by subsidiary design considerations. The CMI drives use an oxide-coated disk surface or medium, which is a lower-cost alternative to much tougher thin-film media that are fast becoming popular in other companies' high-performance hard-disk drives. The ready availability of oxide-coated platters helped CMI fulfill the overwhelming and unanticipated initial demand for the drives. However, because the oxide coatings of such disks are inherently soft, they are very susceptible to damage caused by head crashes.

NO PARK-AND-LOCK The delicate nature of the soft-medium problem was aggravated by the lack of a park-and-lock feature, which automatically retracts the read/write heads away from the part of the disk surface used for storing data and secures them while the power is off. With such mechanisms, an inadvertent jar of the mechanism will not cause the head to scrape across the data area and damage it (assuming the machine is no longer running).

The result of these twin shortcomings left the standard IBM 20-megabyte drives extremely susceptible to damage from merely bumping the machine. Furthermore, because the heads in these disk drives often landed on parts of the disk surface where important data might be stored, jarring the drive or moving the host computer—even when it was turned off—can and all too often does damage files stored on the disk. Worse yet, as John Dickinson recounts in his introductory article, "Courting Disaster: The IBM PC AT," this damage does not show up immediately after it originally takes place but might become apparent only weeks or months later, when you attempt to access the damaged file(s). Should the damaged area of the disk ex-

tend into the file allocation table, the entire disk can be rendered unusable—and irreparable. The only safeguard at your disposal is to make numerous and frequent hard disk backups.

HARD DISK ALTERNATIVES Instead of fixing these problems, both IBM and CMI have denied them and have chosen instead to replace drives as they die, which does you little good when you lose a hard disk full of data. The best solution, then, is for AT users to look at the alternatives.

Fortunately, a number of companies now offer replacement add-in hard disks (as well as alternative drives to enhance entry-level ATs) that overcome the shortcomings inherent in the official IBM hard disk drives.

Among the first companies to recognize the AT hard disk problems was Core International, which collaborated with veteran hard disk maker Control Data to make a series of extremely robust drives with the park-and-lock feature built-in. (Core even claims to have coined the term *park-and-lock*.) Although the Core drives use the more sensitive oxide-coated media, their much sturdier, more expensive, and faster servo/voice-coil head-positioning mechanism has thus far proven itself resistant to head crashes. The company currently offers a full line of AT replacement drives with formatted capacities from 20 megabytes to about 60 megabytes, all now rated at a racy 26-millisecond average access time. The drives with capacities over 32 megabytes are supplied with replacement ROM chips to help DOS and the AT deal with larger amounts of disk storage.

The Systems Division of Priam Corp. also manufactures (and sells under its own name) a line of hard disks designed for installation in the AT. These drives, which use plated media and voice-coil

PC AT Hard Disk Installation Made Easy

It takes less than 15 minutes to install a hard disk.

Disk drive suppliers have been cashing in on just how easy enhancing an AT can be. Anyone with a screwdriver can add a hard disk to an AT in less than 15 minutes.

The process is amazingly quick and easy. Once you slip the cover off your computer, you simply have to remove the two screws from the retaining

brackets at either side of the drive slot. The hard disk then slides into the slot on its guide rails. Before securing the drive, you connect the three cables and the ground wire to the rear of the drive (the connectors are keyed so that they cannot be improperly inserted). Screw everything back together, and you're done.—Winn L. Rosch

technology, have proven themselves very quick and resistant to head crashes. The Priam line comprises three drives with capacities of 24, 42, and 60 megabytes (formatted), which are available through dealers.

MAIL-ORDER MUSCLE Several mail-order suppliers now sell hard disks under the original disk manufacturer's name; the most popular ones are made by Seagate. Seagate manufactures a whole line of products that includes both low- and high-performance drives. The higher-performance models feature both thin-film media and park-and-lock. Like the Core and Priam drives, the Seagate units can almost be treated like brick and can withstand substantially more abuse than the IBM original-equipment CMI drives. Some mail-order suppliers offer similar high-performance drives from manufacturers like Tandon and Rodime.

You might want to avoid one brand name when buying a replacement or enhancement for your AT. Some suppliers are offering exact replacement ATs manufactured by CMI. While these drives have the de facto IBM sanction, they also come with the same worries that come with the original 20-megabyte enhanced AT.

When buying a disk drive from a mail-order supplier, remember that hard disk manufacturers usually will not support yours. They deal only with distributors and companies that put their drives in other products. You will have to depend on the mail-order supplier for support, so make sure that you buy from one that is dependable and has a responsible service program or return policy.

THE HEAVYWEIGHT DRIVE A growing number of AT users are using Iomega Corp.'s Bernoulli Box to store their computers. The Box is a genuine heavyweight among personal computer disk drives because its bulk and technology yield almost complete indestructibility. You can literally pick up and shake a Bernoulli Box while it is operating and the disk will not suffer damage—or even

miss a byte. The Bernoulli Box is also faster than most hard disks at reading and writing long files, and because it uses removable cartridges it can be used to back up itself or other disks and store them securely. Disadvantages include high cost, the need for an external chassis, a single source of supply, and, until recently, the inability to boot your system directly from it.

The newer 30-megabyte enhanced AT uses robust, IBM-manufactured hard disks that are comparable to those offered by Core. Although these drives are essentially free from the problems inherent in the CMI 20-megabyte unit, some users have noted that they are quite noisy. Moreover, the newer ATs that host the 30-megabyte drives have a built-in speed limit of 6 MHz that the original AT lacks. Installing a drive from another supplier can avoid these problems and save several hundred dollars (or more) along the way.—Winn L. Rosch

Magazine Labs benchmark tests than did those of some of the other machines, AT&T enhanced the machine to speed up other disk functions. The 6300 PLUS blew right by the PC AT on the PC Magazine Labs compiler benchmark test and dBASE sort routine. And the 6300 PLUS offers one more plus: it's marketed and fully supported by a big company with an aggressive commitment to becoming a major force in the industry.

BASIC TIME BT/AT ("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) A true AT compatible, the Basic Time BT/AT has a few thoughtful extras like built-in I/O ports, yet Basic Time keeps its price much lower than the PC AT's.

The BT/AT was just slightly slower than an AT in the PC Magazine Labs

prime number calculation test, but the hard disk drive was faster. The machine performed almost identically to the AT in tests of practical applications. Differences you might not notice at first glance include three standard DB-25 connectors for its two serial ports and one parallel port, 256K-bit RAM chips instead of piggyback chips, and for machines produced since December 1985 a motherboard that can hold up to 2 megabytes of RAM. Basic Time manufactures its own multifunction card to give the BT/AT even more memory and I/O capability. The firm also offers a number of optional hard disk drives with capacities of up to 70 megabytes. The BT/AT is a high-quality AT candidate for the price- and power-conscious consumer.

COMPAQ DESKPRO 286 ("High-Performance Alternatives to the PC AT," *PC Magazine*, Volume 4 Number 23) Known for its IBM-compatibles, Compaq has done IBM one better with its Compaq Deskpro 286. The Deskpro is designed to last, with a steel-reinforced frame, an extra steel box to shield the disk drives, a 4½-inch cooling fan, and a 4-amp power supply. The Key Tronic keyboard attaches at the front of the computer, but the power switch is a long awkward reach in the back of the machine. The high-capacity 1.2-megabyte floppy drive can read and write to PC-standard 360K-byte drives just like the AT's can.

These features are nice, but it's the Deskpro's consistently speedy performance that makes it such a strong offering. The 20-megabyte Control Data hard disk drive is more than a third faster in average track-to-track access than the AT's. The 80286 processor's 8-MHz clock speed is

33 percent faster than the AT's 6-MHz speed, although with the Compaq you have the option of switching to 6 MHz. Even the optional 10-megabyte minicartridge tape backup drive is fast.

COMPAQ PORTABLE 286 ("High-Performance Alternatives to the PC AT," *PC Magazine*, Volume 4 Number 23) The 30-pound Compaq Portable 286 is a lugable, high-performance alternative to the AT. It has the same 80286 processor as the AT does, but it rated 30 to 65 percent faster than the AT in PC Labs benchmark tests. This result is partly because it runs at a faster clock speed—8 MHz. However, the Portable 286's miniscribe 3½-inch hard disk is only half as fast as the AT's high-performance drive.

The Portable 286's case and green monochrome display are similar to those of the familiar Compaq Plus, but this machine has a half-height floppy and half-height tape backup drive where the single floppy once resided. An LED on the floppy drive flashes red or green depending on whether it's reading a 360K disk (red) or 1.2 megabyte disk (green). The Portable 286's aluminum panels are mounted with

high-torque, star-headed bolts that make assembly awkward and difficult. But if you need portable AT power, consider the Compaq Portable 286.

HEWLETT-PACKARD VECTRA

("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) Highly IBM compatible and somewhat expensive in a desirable configuration, the Hewlett-Packard Vectra features the distinctive HP engineering touch—a well laid out, neatly routed, and very sturdy machine.

The system box is 30 percent smaller than the AT's, but there is room for up to three half-height internal drives and seven expansion slots. A push-button on/off switch is provided, but the security keylock is optional. The two 16-bit slots will be used by the disk controller and video card. The Vectra uses an 8-MHz 80286

Hewlett-Packard Vectra
Hewlett-Packard Co.
3000 Hanover St
Palo Alto, CA 94304
(800) FOR-HPPC
List Price: With 256K RAM, 360K floppy disk drive, $3,199
Options: 20- or 40-Mbyte hard disk drive, monochrome or color monitor, mouse, graphics tablet, bar code reader, floor stand, communications interfaces, 1200-bps modem, external disk/tape mass storage system, IRMA board
CIRCLE 876 ON READER SERVICE CARD

ITTxtra XP
ITT ISD
Customer Inquiry
2350 Qume Dr.
San Jose, CA 95131
(408) 945-8950
List Price: With 512K RAM, 360K floppy disk drive, 10-Mbyte hard disk drive, serial and parallel ports, *EXP* (intelligent memory management) caching software, $3,995; same configuration plus 20-Mbyte hard disk drive, $4,595
Options: 120K upgrade kit; 1-Mbyte expansion memory board kit; 512K kit
CIRCLE 877 ON READER SERVICE CARD

chip and has a socket for an 80287 coprocessor. The motherboard can hold 640K bytes of RAM; additional memory cards can increase the total to 3.64 megabytes. The PC Labs benchmark tests rated the machine relatively slow in hard disk access times, but on CPU-intensive applications, the Vectra performed well. In an attempt to make the computer easier to use, the Vectra comes with *PAM* (*Personal Applications Manager*), a menu/function-key–driven shell around DOS.

ITTXTRA XP

("High-Performance Alternatives to the PC AT," *PC Magazine*, Volume 4 Number 23) Without an AT expansion slot, 1.2-megabyte floppy drive, or hard disk lock, the ITTxtra XP cannot be considered an AT–compatible. Yet this

worthy IBM PC-XT-compatible computer is less expensive and 30 percent faster than an AT.

The 80286 microprocessor runs at the AT speed of 6 MHz but can easily be downshifted to the PC's 4.88 MHz. The serial and parallel connectors are the same familiar DB-25s that the PC uses, so there's no hassle with special AT cables and adapters.

The ITTxtra XP uses cache memory management, a mainframe technique, to increase its operational speed. This technique makes the ITT's floppy disk drive almost as fast as the AT's hard disk in some instances. In the PC Labs benchmark tests, the ITTxtra XP matched AT processor speed and whizzed by its competition in disk performance operations. Cache utility programs can, however, have problems reading the coding on some copy-protected disks.

Kaypro 286i
Kaypro Corp.
533 Stevens Ave.
Solana Beach, CA 92075
(619) 481-4300
List Price: With 512K RAM, high-density floppy disk drive, $2,995; with 512K RAM, two high-density floppy disk drives, *Word-Star* and *MailMerge*, $4,550; with 512K RAM, 20-Mbyte hard disk drive, high-density floppy disk drive, $4,795; with 512K RAM, 20-Mbyte hard disk drive, high-density floppy disk drive, 20-Mbyte tape backup drive, $5,995
Options: Color adapter and display, $650
CIRCLE 878 ON READER SERVICE CARD

■ PC AT ALTERNATIVES

KAYPRO 286i ("High-Performance Alternatives to the PC AT," *PC Magazine*, Volume 4 Number 23) Although it doesn't much resemble the AT, with its dark green color and distinctive styling, the Kaypro 286i is a pure AT-compatible. Since the machine runs PC-DOS 3.x without any trouble, it should have no problem running PC software or AT-compatible expansion boards. You shouldn't need a 640K-byte memory expansion board—the 286i comes with 512K bytes of RAM, but you can put two 64K-bit chip sockets on the system board. Although the 286i monitor's background is not as black as IBM's or its colors as vibrant, it's still an IBM-compatible display.

The keyboard is mushy; the manual is skimpy, but these are minor defects. The Kaypro 286i scored nearly the same as the AT in the PC Labs benchmark tests involving memory and floppy disk access. However, its hard disk performance rated almost 30 percent better than the AT's. Real-life applications may not be quite that fast, perhaps about 10 percent better.

FACT FILE

PC's Limited AT
PC's Limited
1611 Headway Circle, Bldg. 3
Austin, TX 78610
(512) 339-6800
List Price: With 1-Mbyte RAM, three ports, 1.2-Mbyte high-density floppy disk drive, combined floppy/hard disk controller, AT-style keyboard, 192-watt power supply, clock/calendar with battery backup, $1,995
Options: 20-Mbyte hard disk drive, Hercules-compatible monochrome graphics display adapter, Princeton Max-12 monitor
CIRCLE 675 ON READER SERVICE CARD

PC'S LIMITED AT ("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) The PC's Limited AT is faster, more flexible, and two-thirds the price of the AT it emulates.

The PC's Limited AT's Faraday Electronics ATease system board, based on the Intel 80286 microprocessor, has a socket for an optional 80287 coprocessor and handles either 64K-bit or 256K-bit RAM chips for up to a grand total of 1,024K bytes of RAM. Its ROM chips can be altered for industrial applications that need specially designed ROM-resident routines. The board's configuration is set by moving awkwardly placed jumpers—instead of DIP switches. The jumpers let you select the kind of keyboard you'd like—PC style or the newer AT style. Jumpers also configure serial ports to function as either AT 9-pin or PC 25-pin standards and the other ports to follow RS-232 or RS-422 communications standards. The PC's Limited AT comes with a single Mitsubishi 1.2-megabyte half-height floppy drive. There's enough room for both an additional half-height floppy and two full-height hard disk drives.

SPERRY PC/IT ("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) Aimed at the power user, the Sperry PC/IT features a higher processing speed than the AT, double its memory-expansion capabilities, and double its mass-storage capacity. If you're looking at multi-user systems, this heavy-duty machine can accommodate up to eight remote work stations under XENIX System V.

On PC Labs benchmark tests, the PC/IT gave a solid performance. Its hard disk access time was one of the fastest, and its index score on the Norton SysInfo test, 8.4, was one of the best. However, the machine was one of the slowest on the prime number test.

The 80286 chip runs at 8 MHz, but it can be set to run at 6 or 7.16 if necessary. The standard 512K bytes of RAM can be doubled on the system board, saving some

FACT FILE

Sperry PC/IT
Sperry Corp.
P.O. Box 500
Mail Station B-200
Blue Bell, PA 19424
(215) 542-4011
List Price: With 512K RAM, 1.2 Mbyte floppy disk drive, AT-compatible keyboard, monochrome display, and operating system, $4,340
Options: Increase to 1 Mbyte without adding additional slots; increase to 5 Mbytes with memory board; 44.6-Mbyte hard disk drive, 60-Mbyte tape backup drive
CIRCLE 674 ON READER SERVICE CARD

of the eight expansion slots. A 1.2-megabyte high-density floppy disk drive is standard; the system can handle three additional storage options, and so you can mix and match a 360K floppy, a 60-megabyte cartridge tape backup drive, and a 44.6-megabyte hard disk. It can support two hard disk drives, pushing maximum internal storage over 90 megabytes. Sperry offers three Key Tronic keyboards for the PC/IT: the Standard, the Professional, and the Advanced. The company also offers three monitors: a monochrome display, a medium-resolution color display, and a high-resolution color display.

TEXAS INSTRUMENTS BUSINESS PRO ("Computing Options for Power Users," *PC Magazine*, Volume 5 Number 4) Texas Instruments designed the Business Pro as a heavy-duty but flexible AT-compatible with enough room for six inter-

Pick A Racehorse, A Workhorse, Or Your Choice Of Saddles

Trying To Rope in a pure bred PC or AT compatible computer system? Basic Time has the system you've been looking for. With more than 10 years as a computer manufacturer and distributor, Basic Time knows the breeding it takes to be real reliable performers. That experience has created systems with carefully selected and integrated components, providing top notch performance at a surprisingly low price.

Run With Our Racehorse-The BT/AT.

This 80286 computer with hard access drives of 20, 40, or 70Mb capacity, running at selectable 6 or 8 Mhz clock rates will run circles around the IBM™ AT. Its new system board comes standard with a full 640K of RAM and can still be expanded to 2Mb on the system board, with up to 15.5Mb directly addressable by the system. Also standard are two serial ports and a parallel port on the Basic Time system board, keeping precious I/O slots available for future expansion.

Standard features include an 84-key keyboard, 1.2Mb/360K floppy, MS-DOS and GW-BASIC. Rounding out the system is a Hercules compatible monochrome monitor (color or EGA compatible color optional). All this and more at the lowest price available for an AT compatible*.

Try Our Workhorse-The BT/XT.

A new standard in price/performance for an 8088 computer. 8 slots, 256K RAM, AT type keyboard, Hercules compatible monochrome monitor and adapter, 20 Meg hard disk, floppy drive, 135 Watt power supply, MS-DOS, and full PC compatibility.

Your Choice Of Saddles

Either horse you choose, we can outfit you completely. Our HR series monitors support monochrome, color, or EGA adapters. Communication is easy with Basic Time internal or external modems. Hard disk storage is simple and reliable with our 20Mb systems for PC's and BT44 and BT70Mb drives for AT's. Tape backup systems are available to secure your data too. Need more memory and I/O ports? The BT6Plus and AT4x4Plus multifunction boards give you unrivaled bang for your buck.

For Information

on where to purchase Basic Time products, call or write:

Basic Time
Department P
3350 Scott Blvd.,
Bldg. 52
Santa Clara, Ca. 95054

(408) 727-0877

basic time

*Infoworld Sept. 2, 1985, Page 1.

CIRCLE 196 ON READER SERVICE CARD

T W O
NEW ALTERNATIVES
TO THE PC AT

IBM's would-be competitors keep churning out new AT-like, high-performance machines. When NCR's PC8 and TeleVideo's AT Model II emerged from PC Magazine Labs, one looked worthy, the other merely overpriced.

TeleVideo Systems Inc. and NCR Corp., two manufacturers that first entered the personal computer marketplace with uniquely designed PC compatibles, are back in the fray, this time with AT alternatives. In design, construction, and performance, this particular twosome illustrates some of the best and worst characteristics of AT-like machines. For a summary of features and a quick comparison with other high-performance computers, see the features table in this issue's cover story.

TELEVIDEO AT MODEL II

The TeleVideo AT Model II is a machine that many prospective purchasers may overlook as they wade into the murky AT-alternative marketplace. Perhaps that is just as well. Though it outperforms the IBM PC AT on many PC Magazine Labs benchmark tests, the quality of its construction doesn't inspire much confidence in its hardiness.

Neither its Rodime 20-megabyte hard disk nor its Toshiba quad-density floppy

drive came through the testing without exhibiting at least some problems. Indeed, partway through the first day's testing, the Toshiba floppy drive's door handle came off in my hand, halting all testing until another drive could be shipped in from the manufacturer.

Like NCR, TeleVideo made its initial entry into the PC-compatible market with a machine that departed radically in appearance from the IBM PC. An all-in-one unit, the original TeleVideo PC featured such innovations as a built-in tilting monitor and vertically stacked floppy drives. It all added up to a striking design with a high-tech aesthetic appeal and a small footprint.

In designing its AT compatible, TeleVideo, like NCR, has renounced its maverick ways and meekly followed IBM's lead. Aside from its slick monochrome monitor, there isn't much to differentiate this system from any other 8-MHz AT-compatible machine on the market, and few improvements have been made to justify the TeleVideo's relatively high price.

DOUBLE-SCANNING The monitor is, in fact, the most remarkable part of the system. Using TeleVideo's own display technology, it can produce resolutions of 640

by 400 pixels by double-scanning each line (that is, each horizontal line is displayed twice on the screen). The image is crisp, sharp, and easy on the eyes. The 16-bit monochrome adapter card supplied with the monitor is capable of rendering color displays in various shades of green with remarkable clarity, and for good reason. If you prefer color, you'll need to look to out-

side manufacturers for color/graphics adapters and monitors. TeleVideo doesn't offer color as an option.

The monochrome monitor does not require a separate AC power line, which may help you keep the cable octopus at the back of your systems unit under control. The newly shielded cable that connects the unit to the adapter card's nine-pin port also draws power. A tilt-and-swivel pedestal is built into the unit for convenient positioning.

The Model II configuration normally features a 45-megabyte Seagate hard disk; our test unit, however, was fitted with only the 20-megabyte optional hard disk made by Rodime. On the CORE International benchmark test, this drive failed to meet

IBM's specifications for the PC AT. In use, it was apparent that 8-MHz operation was pushing this drive to its limits. So, although the performance charts show the TeleVideo's 20-megabyte drive outperforming the AT in disk accessing tasks, I have doubts about the drive's long-term durability.

TeleVideo reps claim that the 45-megabyte primary hard disk normally found in the Model II features a 1:1 interleave ratio (that is, one sector is read in each revolution of the disk, as opposed to IBM's three revolutions per sector), which should produce remarkable drive access times. If so, why support such a primary unit with such a mediocre drive as the Rodime?

FEW AMENITIES Despite the TeleVideo AT's relatively high retail price, its systems unit lacks many of the amenities taken for granted in many other AT-alternatives. There is no key lock, nor, for example, is there any way to secure the systems unit enclosure to the chassis a feature commonly offered in machines costing far less. Though the Rodime hard disk has a red LED to indicate when the drive is ac-

The TeleVideo AT Model II uses TeleVideo's own display technology to produce 640 by 400 pixel monochrome resolution. The machine features eight expansion slots (right).

PC LABS BENCHMARK

TeleVideo AT Model II vs. IBM PC AT

Model II ■ Hard Disk ■ Quad Density
AT ■ Hard Disk ■ Quad Density

Disk I/O 512 Bytes   576 Bytes   All results are in seconds

The disk I/O test measures the time it takes to create a 200K-byte data file, using records of 512 bytes and 576 bytes and then perform a random read of 256 records from the created file, followed by a sequential read of the same records. The test compares the two computers' disk drives.

Prime Number Calculation

The prime number calculation test measures the speed at which the computer can find all the prime numbers between 1 and 50.

This test assesses the integration of the system as a whole, concentrating on interaction among the hard disk, microprocessor, and RAM. The compiler program development tool measures the speed of a two-step, self-timing DOS batch file that runs a total of six different routines on 81 individual database records consisting of 154 bytes.

Compiler Routine

Stage 1 takes a 341-line assembly code file (.ASM), converts it to binary code, and link-edits it with other binary files to make an executable file.

This database applications test accesses hard disk processor interaction by performing a series of disk-intensive dBASE II, Version 2.41 tasks. The self-timing DOS batch file runs a total of six different database records on individual database records consisting of 154 bytes.

dBASE Routine

each sorting on a database file (.DBF), indexing on 2 of the 13 data fields in each record, copying to a temporary database file, setting two indexes on a database file and appending a record, deleting all records, packing and systematically clears the spreadsheet.

Designed for a 256K environment, this spreadsheet applications test assesses the computational speed and RAM management capabilities of the machine by

1-2-3 Routine

using a 1-2-3 macro that performs a series of both global and individual worksheet tasks. The macro copies and recalculates a 10-cell range 48 times, moves 100 cells, deletes 100 cells, and then systematically clears the spreadsheet.

Unquestionably faster than the IBM PC AT, the TeleVideo AT Model II whizzed through every benchmark test routine like a champ. Even disk I/O times—a weakness of many an otherwise-superior machine—show careful coordination of hardware to 8-MHz operations.

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tive, there is no corresponding opening on the TeleVideo's gray plastic front panel to let you see this light. That flimsy plastic front is atypical of AT-compatibles in this price class; though I did not test the unit for radio emissions, it is clearly far less shielded than metal. Despite its fast clock and good benchmark performance, this machine may suffer more technical problems in the long run than one has a right to expect.

In a market offering highly regarded AT options at very reasonable prices, as well as machines in the above-$4,000 range that feature useful enhancements and construction surpassing IBM's offering, the TeleVideo AT lacks a niche. De-

NCR PC8

NCR Corp. has decided to play ball by the same rules as everyone else. Made in West Germany by NCR's European counterpart, the new NCR PC8 is a far cry from the distinctively different NCR Personal Computer Model 4 that *PC Magazine* re-

viewed in the December 11, 1984, issue as "Not a Cash Register," Volume 3 Number 24, page 146).

The PC Model 4, with its high-tech styling, sought to distinguish itself as a PC-compatible that didn't look like one. The new PC8 is yet another AT lookalike, albeit one created with considerable craftsmanship and attention to detail throughout its construction, while maintaining a conservative outward appearance.

NCR has not committed the PC8's rather large systems unit to either a flat-on-the-desk or vertical tower orientation. Though the NCR logo is affixed sideways, so that it reads correctly in a vertical configuration, the box includes oversized felt feet to stick on the bottom of the unit should you want it to take up most of your desk space.

In the horizontal position, the big feet are necessary. If they are not in place you can't open the unit's key compartment, a neatly concealed door on the front panel that flips down to reveal the key slot and two LED indicators. This hidden door also provides access to the PC8's third half-height drive slot, in which you can mount a backup cartridge drive internally without sacrificing one of the two regular floppy drive slots.

Despite the NCR PC8's unconventional styling, it works exactly like a standard IBM AT—only faster. The system unit (right) uses an unusually neat, efficient design.

KEYS AND MORE KEYS The PC8's ultrawide keyboard sports 30 individual function keys, 20 of which are aligned across the top of the board. Each of the function keys along the top (F11 through F30) duplicates the standard 10 function keys used in conjunction with the Shift or Ctrl keys—thus F20, for example, is the same as Shift-F10, and F30 equals Ctrl-F10. Single-key command sequences for any application done with a macro processor and the NCR PC8 are an intriguing possibility.

The general layout of the keys follows the IBM PC AT pattern almost exactly, with an added bonus—duplicate special-purpose keys in abundance. Located between the alphanumeric and the numeric keypads is a duplicate set of cursor control

keys (allowing you to set the numeric keypad permanently for numbers-only use), and there are duplicate Ins, Del, PgUp, PgDn, Ctrl, Home, End, and Enter keys.

The keys themselves are soundless, and their feel is lighter than those on the IBM keyboard. Even so, you'll have no trouble getting used to it. Indeed, it makes the IBM AT keyboard seem limited.

The NCR's systems unit incorporates some of the slickest detail engineering I've

ever seen inside a personal computer. The interior must have been designed by a neatness freak—there's a place for everything. Exact-length ribbon cables are fastidiously folded and routed between the drives and the power supply, plastic clips hold connecting wires tightly to the chassis, and there are even special clips to hold the extra power supply and ribbon cable lines for add-on drives.

The PC8 uses an Intel 80286 operating at 8 MHz, and its performance in those operations testing CPU performance without disk I/O surpassed that of the IBM PC AT. Unfortunately, neither the hard disk (built by Control Data Corp.) nor the TEAC quad-density floppy drive took advantage of the faster clock rate in PC Labs' disk-accessing benchmark tests.

The CORE hard disk test results were especially surprising since this drive undeniably exceeds IBM specs for the AT. The most likely explanation for this anomaly must lie in the NCR's BIOS drivers; unlike IBM's BIOS drivers, which have been carefully optimized for the drives IBM uses, NCR's are not married so closely to the hardware. A machine with the capability of processing data so quickly internally should not be handicapped by slow disk-accessing routines.

The PC8 submitted for review was equipped with NCR's own color/graphics

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■ TWO PC AT ALTERNATIVES

PC LABS BENCHMARK

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This test assesses the integration of the system as a whole, concentrating on interaction among the hard disk, microprocessor and RAM. The compiler or program development test measures the speed of a two-step, self-timing DOS batch file using the IBM Pascal Compiler and Microsoft Pascal Linker program.

Compiler Routine — Stage 1 takes a 341-line assembly code file (.ASM), converts it to binary code, and links each with other binary files to make an executable file.

dBASE Routine — This database application test processes hard disk operations by performing a series of disk-intensive dBASE II, version 2.41 tasks. The self-timing DOS batch file runs a total of six dBASE routines on 8 individual database records consisting of 154 bytes each working on a database file (DBF), indexing on 2 of the 13 database fields in each record, copying to a temporary database file, appending records and deleting a record and packing (physical removal of deleted records) the database file.

1-2-3 Routine — Designed for a 256K environment, this spreadsheet application test assesses the computational speed and RAM management capabilities of the machine by using a 1-2-3 macro that performs a series of both global and individual work sheet tasks. The macro copies numbers, moves 100 cells, deletes 100 cells, inserts 100 cells, and then systematically clears the spreadsheet.

The NCR PC8 dramatically outperformed the IBM PC AT in every test using actual applications to simulate real-world computer use. The disk I/O routines, however, revealed that the PC8's drives could have been better designed for use with such a fast system.

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adapter and 14-inch, high-resolution monitor, which add another $1,260 to the system's cost. The monitor displays characters composed of single dots, which makes the character set crisp and sharp. Your eyes will appreciate the sharper character definition, though whether it justifies the added cost is between you and your wallet.

Unfortunately, the monitor is housed in a clumsy, oversized pyramid. Apparently, this monitor was intended to be used with a separate pedestal of some kind; none, however, was provided with the machine

reviewed. For comfortable viewing I had to perch the monitor on a shelf a foot above the system unit, where its angle of inclination caused the supposedly glareproof screen to reflect the ceiling lights. Don't consider buying this monitor without a tilt-and-swivel stand.

If the IBM PC AT is the Cadillac of PCs, then the NCR PC8 is the Mercedes. Its performance outpaces the AT's and its overall construction quality is superb. In many ways, the NCR PC8 makes the AT seem almost crude by comparison.

For thousands of years, man used personal computers without decent tape backup. Enough.

Personal computers have come a long way. Unfortunately, tape backup systems have not. Their functions are primitive, they're frightening to install and truculent to use.

Genoa's Galaxy™ Systems are more highly evolved. So not only do they outperform competitive systems, but using them is actually something that can be done by an ordinary human.

The simpler. The better.

Our software is what makes the difference between our systems and everybody else's. And it's designed to help you use the system easily in either of two modes. Namely, menu-driven or batch file.

The menu mode operates true to its name, with menus showing all the commands you have to choose from. And there isn't a thing you can't do from the menu mode because it's comprehensive.

You'll want to use the batch mode for routine operations though, because it allows you to create a "file" to contain those operations and run them automatically, just by hitting a few keys.

But probably the best example of just how downright civil the Galaxy systems can be is our auto backup. You just preset the time and the desired function, and the system does the rest. Automatically.

No other tape backup systems, by the way, operate this simply.

The features all tape backups should have. But don't.

Before you make your first backup — which is the right time to do this — our installation software checks your disk configuration to make sure your tape drive will run at top speed. And it checks the entire system to guarantee it will perform as promised. No competitive system offers anything like it.

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file-by-file restore just because you hit the wrong key.

You can also do a file-by-file restore from an image backup. So you can get back the one file you need rather than all the files you don't.

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OKIDATA MAKES GOOD:

THE MICROLINE PRINTER SERIES

Favorites with many PC users, Okidata's Microline series printers
received less-than-enthusiastic notices in last fall's comprehensive
printer issue. Okidata took our criticisms to heart and overhauled
its machines—and earned itself a second look.

The secret to keeping up in this industry is don't eat, don't sleep, don't even blink. Only a little more than half a year has passed since *PC Magazine*'s most recent printer issue (Volume 4 Number 19), and it's time for an update—at least for the popular Okidata Microline series.

This mini Project Printer Report follows the same format as *PC Magazine*'s full-scale printer projects, right down to the printer guide table. Consider it a supplement to the 1985 printer issue.

How did this project come about? The six Okidata Microline printers reviewed here fared rather poorly last fall—much to *PC Magazine*'s and Okidata's disappointment—but the printers have all been improved since then, substantially enough to warrant another look. When Okidata informed special-projects editor and printer expert John Dickinson of the product enhancements, he reacted with great enthusiasm and scheduled this special report.

When Okidata introduced its new 180 series and 190 series Microline printers, some of the stiffest competition the company faced was its own reputation. The old Microlines—the 82 and 92—were short on beauty, but they had the feel of a brick, which inspired a justified confidence in their reliability.

The new Microline printers reviewed in the 1985 printer issue were much prettier, but compared to the old standbys they seemed to be—well, "delicate" would be the charitable way to put it.

Okidata supplied six printers for testing: two 182s, two 192s, and two 193s. Each model comes in two flavors—a standard Oki version and an IBM graphics–compatible version.

When PC Magazine Labs put these units to the test, they came up wanting. Contributing editor Charles Petzold wrote of the 193: "The two top covers, one for the front and one for the tractor feed, fall off easily, and the tractor feed is so flimsy it twists like a . . . snake.''

Nor was that just one reviewer's reaction.

Robin Raskin, in her review of the IBM version of the 192, noted that "the light plastic cover falls off . . . at the touch of a fingertip, and the pin feeders are barely strong enough to keep the paper from being mangled.''

Vincent Puglia reported that the access cover on his 182, "blew off the top and sailed 6 or more inches into the air.''

And reviewer Jim Forney reported that the acoustic cover of the 193 fit poorly, the print quality was inferior to the 92, and the tractor assembly was "cheap, flimsy, and ill-fitting." Forney, a longtime Microline 92 owner, concluded, "I'm still glad I own an Oki . . . but I'm glad it's not a Microline 193."

The most forgiving review was my own, which pointed out that "the Microline 182 is an economy model, providing little beyond basic printing."

These negative findings left many of us at *PC Magazine* as disappointed as the people at Okidata must have been. Most of us have fond feelings toward Okidata printers, and some of us admit to being emotionally attached to our Okis.

To best judge how much the printers had been improved, *PC Magazine* had each of the updated Microline models tested by the same reviewer who passed judgment on the original. And so five reviewers gathered at PC Labs to test the six printers, and we ran the new Microlines through the standard PC Labs' printer tests.

By the end of a morning's testing, most of us were mildly elated. The improved Microline printers didn't look any different from their immediate predecessors, but they certainly acted differently: Access covers stayed in place, paper fed without jamming, print quality looked better, and the machines generally behaved the way they should have in the first place.

To some of us, at least, the printers didn't look so flimsy; they'd moved up to the realm of "attractively designed." But where, we asked ourselves, did the true differences lie?

OKIDATA EXPLAINS According to Okidata product manager Gary Bailer, the differences between the original Microlines and the current versions are subtle, but real. Paper feed has been improved by adding a guide for the paper and by redesigning the pin feed mechanism to reduce the size of the pins and increase the distance between the center of the pins and the edge of the pin feed housing. Okidata fixed the bail arm so that it no longer pops out. And as several reviewers note in their evaluations, the access cover has been fixed by adding clips that hold it in place.

According to Bailer, all these fixes are included in all printers being shipped as of this writing. What's more, all the changes can be retrofitted to earlier models. And to its credit, Okidata's policy on any "major problem," such as the access cover popping off, is to retrofit all printers in inventory and also any printers that come in from customer complaints—regardless of the warranty period.

> ■ Some of us admit to being emotionally attached to our Okidata printers.

Okidata is also sending out field change orders on such major problems, which means that even if you don't complain, your printer will automatically be upgraded the next time you bring it in to an authorized Okidata service center.

One fix that had not been added in time for PC Labs testing is a paper guide for the narrow column printers to keep the output paper from feeding back through the input slot. As several reviewers noted, this is the one remaining problem in the paper-feed mechanism. As of this writing, Okidata is testing a new paper guide to solve this problem. When it becomes available, a retrofit will be offered free of charge.

Some changes have been implemented along with the fixes. Probably the most notable change is that Okidata is now making kits available for making its standard printer IBM-graphics-compatible. The kits include a PROM (Programmable Read Only Memory), a new manual, a warranty card, and the appropriate label for the printer. For the Microline 192 and 193, the IBM-graphics-compatible kits include Okifont software for devising downloadable character sets.

The price of the conversion kit has not been set as of this writing, but Okidata expects it to be about $100. As several reviewers note, Okidata recommends that users go to authorized service centers to have the new PROM installed. The cost of

installation may range from no charge to about $20. The kits themselves will be available only through the Okidata Logistics Group. (For further information call (800) OKIDATA.)

Another noteworthy change is the addition of a near-letter-quality (NLQ) mode to the 182 models. This feature will be standard by the time you read this. For those who already have unenhanced Microline 182s, an NLQ kit is available for $24.95. This consists of one PROM chip, installation instructions, and documentation, and is available from Okidata directly or from Okidata dealers. Be aware that there are two kits available—one for the standard version of the printer and one for the IBM-graphics-compatible version.

TOUGH AND LUGGABLE In terms of appearance and durability, Bailer points out that the new Microlines follow a totally new design to fit into "the modern office environment." They are meant to be quasiportable—a printer to take along with your Compaq on a business trip.

In particular, the new printhead technology in the new Microlines is lighter and, according to Bailer, more durable than the older technology of the Microline 82 or 92. In Okidata's fragility tests, it took greater force to produce damage to this printer than to its predecessor. The mechanism is mounted in such a way that the mountings and the fragile-looking plastic cabinet act as shock absorbers.

While discussing the printer's ruggedness, Bailer picked up one corner of a working Microline and dropped it about 6 inches without any noticeable effect. Reviewer Petzold was so intrigued by this that he decided to try his own drop test (see sidebar entitled "The Drop Test"). Petzold's test showed that the printer is not indestructible, but that it can certainly take the wear and tear of an office environment.

All told, the original perception of these printers as flimsy seems to have had more to do with ergonomic factors than with any serious problem in the mechanism itself. Now that the access cover, paper feed, and other problems have been fixed, the Microline 180 series and 190 series printers look a lot more attractive. Okidata has earned this second chance.—M. David Stone

MICROLINE 182 (IBM Version)

I summed up my review of the original Okidata Microline 182 (IBM Version) by saying that I would not trade in my old Epson MX-80 with Grafttrax for it. Now I would. Not only is the new Microline sturdier than the first version I tested, but it offers some new features as well. The 182 is not the quintessential printer—it still has faults and it still looks less sturdy than the old Okidata printers—but it has become a serious contender.

The Microline 182 offers a nearly complete array of print enhancements. Whether you want draft-quality print for your personal reminders or a highly legible near-letter-quality font for your business letters, you can find it in the 182. Other print enhancements include emphasized, enhanced, and underlined print. The PC Magazine Labs speed tests rated the draft print at a little over 80 characters per second, the emphasized print at almost 57 cps, and the near-letter-quality font at just under 34 cps.

In addition to print enhancements, the Microline 182 provides page-format commands, horizontal and vertical tabs, and a variety of character sizes from condensed to double-width. It can also print IBM-compatible graphics.

When I powered up the unit and fed a few form feeds, the lid remained where it belonged. Okidata has now incorporated a plastic pin system that locks the lid into place, rather than leaving it to hover above the unit. While this cut down many of the problems I had with the earlier version, the printer still occasionally required a Hoover vacuum cleaner by sucking outgoing paper back into the paper feed slot. Presumably,

■ All of Okidata's Microline upgrades can be retrofitted to earlier models.

the addition of a paper separator will remedy this problem.

Because of the unit's lightweight appearance, I went beyond the normal PC Magazine Labs tests and attempted to test the Microline 182's ruggedness. I lifted the unit as it was printing and began swaying it side to side. As it continued to print, I increased the angle of each upswing until I had the 182 doing a loop-the-loop. Finally, I held it upside down and shook it—not too gently.

Not only did the printer continue print-

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■ OKIDATA

ing, but the output was as high in quality as in the official test run. I do not believe many printers would pass this test—and not just because most of them are too heavy to lift. Appearances aside, Okidata has incorporated a new technology that allows the printhead to withstand a fair amount of abuse.

The Okidata Microline 182 has been overhauled since its introduction. No one can reasonably argue that the unit shares the Sherman tank appearance of its predecessor, the Okidata Microline 82. However, in this case at least, appearance is deceiving. The Microline 182 is at least as rugged as the old 82, and in some ways more so.—**Vincent Puglia**

MICROLINE 182 (Standard Version)

I've tested an Okidata Microline printer three times now. The first for *PC Magazine's* 1985 project printer issue. My reaction then to the standard version of the Microline 182 would best be summed up as: "It's not a great printer, but what do you expect for $299?"

The second test was for PC Labs' focus on sheet feeders (see "Sheet Feeders: One Page at a Time," *PC Magazine*, Volume 4 Number 24). The Okidata CSF 900 was one of the sheet feeders on the list, and I tested it on the Okidata Microline 192 (Standard Version). (The 182 does not accept the sheet feeder.) My conclusion then was that the CSF 900 fared better as a sheet feeder than the 192 fared as a printer.

Well, the third time was charmed; the Microline 182—and indeed the entire Microline series—has caught up to the CSF sheet feeder in quality and value.

The new version of the Microline 182 is slightly slower than the original. The PC Labs speed test clocked the printer at 80.3 cps as opposed to 82.2 cps for the first model. However, it isn't clear from the test results whether this 2-cps difference reflects a change in printer design or whether it is simply a matter of individual variations among printers.

Like the original Microline 182 offered, the new unit's print features include

PRINTER GUIDE

The Key to the Printer Guide

PRINTING FEATURES

H Horizontal emphasis (bold)

V Vertical emphasis (double strike)

C Correspondence quality

U Underline

S Sub/superscript

R Red ribbon

FORMATTING FEATURES

P Proportional spacing

J Justified lines

C Centered lines

LH Variable line heights

FL Variable form length

HT Horizontal tabs

VT Vertical tabs

SOUND LEVEL

The blue bar shows the rated DBA. The orange bar shows the measured DBA. The rule is the average for all printers, 72.

COMPATIBILITY

IBM PC Compatibility

A High order characters

O Low order characters

N Neither

Graphics Compatibility

P PC-DOS Graphics Command

S Vendor Software

X Incompatible

— No graphics

IBM Command Sequence Compatibility

I IBM Matrix/Graphics Pro

E Epson

D Diablo 630

Q Qume Sprint

? Other

PC Magazine's Printer Guide, which appeared in Volume 4 Number 19, pages 183–185, will help you choose the printer of your dreams. The table on the facing page provides essentially the same information for the updated versions of the Okidata Microline series printers. Consider it a supplement to the original guide. Comparing it with the 1985 table will not only allow us to see how the Microlines themselves have improved but to compare these printers with all the others we've reviewed.

To make the best choice, first decide how you'll be using the printer and what you'll be using it for. That information will help you determine how fast you need it to print, how fancy its print quality must be (as well as how fast it needs to print in a high-quality print mode), how quiet it needs to be, and whether compatibility is a pertinent issue.

While the print samples in the Printer Guide show you what the printer's output looks like (blown up 400 percent), the listings of each printer's printing and formatting features tell you how far beyond "plain vanilla" printing it will go. Emphasized print and underlining, for example, are useful for almost any document because they allow you to boldface or underline your points or highlight your numbers. A printer with a variety of type pitches can print everything from a speech or script to a wide spreadsheet. The ability to vary line heights and printing form (page) lengths is useful in many applications.

PC Magazine's Printer Guide also tells you about each printer's text and graphics compatibility with the IBM PC, which can be important for applications ranging from screen dumps to database reports. The Guide also tells if your printer of choice is compatible with a more popular printer line, such as Epson or Diablo; if it is, that compatibility will almost guarantee seamless word processing or graphics support.

The Printer Guide is helpful when you make a printer-buying decision because it shows you a large amount of information in a very small space. But don't overlook the written reviews—it's there that you'll find those immeasurable qualities that can make all the difference in the world.

MODEL		TYPE. CARRIAGE WIDTH, PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM PC Graphics Other printers
Microline 182 (IBM)							
Qm	Okidata Microl . Corresponden hanced print. ault. Correspo	Dot matrix impact 10.0 $299	120 rated 80.3 default 33.9 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S LH FL HT VT	58 78	🔻 🔺 P I
Microline 182 (Std.)							
Qm	Okidata Microl fault. Corresp nting. Emphasi er On Default.	Dot matrix impact 10.0 $299	120 rated 80.3 default 34.2 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S LH FL HT VT	58 78	🔻 🔺 ✕ ?
Microline 192 (IBM)							
Qm	Okidata 192: ce Quality. En ic Print. Unde spondence Qual	Dot matrix impact 10.0 $499	160 rated 96.0 default 35.0 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S P LH FL VT	58 80	🔻 🔺 P I
Microline 192 (Std.)							
Qm	Okidata 192 St respondence. I Power On Defau mphasized. Enh	Dot matrix impact 10.0 $499	160 rated 96.0 default 35.0 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S P LH FL VT	58 76	🔻 🔺 ✕ ?
Microline 193 (IBM)							
Qm	Okidata Microl lt. Correspond alics. Power O anced. Emphasi	Dot matrix impact 16.0 $699	160 rated 96.0 default 34.0 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S P LH FL HT VT	55 78	🔻 🔺 P I
Microline 193 (Std.)							
Qm	Oki 193 Standa ondence Qualit Emphasized. It rrespondence Q	Dot matrix impact 16.0 $699	160 rated 95.9 default 34.9 quality	5.0 10.0 6.0 12.0 8.5 17.1	H V C U S P LH FL HT VT	55 73	🔻 🔺 ✕ ?

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F A C T   F I L E

Microline 182
(Standard Version)
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600 (in N.J.)
List Price: Parallel version,
$299; serial version, $359;
plus $79 for 192K board
Dim.: 3.2 × 14.6 × 10.9
Weight: 9.9 lbs.
Country: Japan
In Short: The Microline 182
(Standard Version) lacks IBM graphics compatibility, but it offers draft quality print at 80 cps and near-letter-quality print at 34 cps. It's a quality budget printer.
CIRCLE 658 ON READER SERVICE CARD

10 and 12 characters per inch (cpi), condensed and enlarged print, vertical and horizontal emphasis, superscripts and subscripts, and underlining.

A welcome addition is a near-letter-quality mode, which was notable for its absence during the last set of tests. The NLQ mode is honestly named, and its 34-cps speed compares favorably with the competition in this price range.

The standard version of the printer still lacks compatibility with either IBM graphics or the IBM high-order character set, but Okidata now sells its that the new standard version of the 182 into the IBM version; all that's needed is the change of one ROM chip. Okidata recommends that users let Okidata authorized service centers take care of the change, but the chip switch is easy enough for those who are comfortable roaming around the innards of their machines.

One or two minor problems remain with the 182. In my review of the original version, I wrote, "The printer's enhanced print mode (vertical emphasis) merely offsets the dots to give a squiggly, out-of-focus effect." This has been improved, but the out-of-focus effect is still there. Also, the noise level is still high, though tolerable thanks to its low pitch. But emphasis now is on "minor," not "problems." Still priced at $299, the Microline 182 is a must-see for anyone on a low budget.

—M. David Stone

MICROLINE 192
(IBM Version)

When I first reviewed Okidata's Microline 192 (IBM Version), I compared the printer to the then-new Coca-Cola, lamenting that change was not always for the best. Unlike Coke, Okidata has not revived its classic 192, but the company has fixed the 192 so that the problems are all but gone.

The new, improved 192 is still compact enough for the desktop computing set, but the lightweight, streamlined design is no longer cheapened by flimsy parts. The original 192 included such features as an access cover that flew off the printer, pin feeds that couldn't hold a sheet of paper on course, and a less-than-functional paper bail. All of these problems are, blessedly, gone. The printhead mechanism has significantly less play.

The improved 192 is still plagued by some paper-feed problems, but they are far less dramatic, requiring only a little care after tearing off a sheet of paper. Because of the tear bar's placement deep beneath the access cover, the paper, once torn, can go in any direction it pleases, typically wrapping itself around the roller. According to Okidata, this last paper-feed problem should be eliminated by the introduction of a new paper guide this spring.

A reasonably priced optional sheet feeder adds extra value, letting this inexpensive dot matrix printer handle many demands of the office environment. The sheet feeder is easy to install, simple in design, and low in cost.

You can purchase the 192 with either the standard ROM or the IBM-compatible ROM, and a conversion kit is available for those who want to change. Thus the old Plug 'n' Play flexibility is once again an option, but users can still buy factory-configured printers.

Instead of dreaded DIP switches, the Microline 192 sports an easy-to-use menu-

F A C T   F I L E

Microline 192
(IBM Version)
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600 (in N.J.)
List Price: $499
Dim.: 3.2 × 14.6 × 10.9
Weight: 9.9 lbs.
Country: Japan
In Short: The Microline 192's (IBM Version) light-weight design emerges as a plus, making the printer slim, light, and huggable. Features include an impressively readable NLQ mode using a 17 × 17 dot matrix.
CIRCLE 659 ON READER SERVICE CARD

■ Instead of the dreaded DIP switches, the Microline 192 sports a menu-select mode.

select mode. You can change over 50 printer attributes by pressing front-panel buttons. These settings remain in nonvolatile memory. Anyone who's ever despaired over banks of poorly labeled DIP switches will appreciate this feature.

The IBM-compatible version of the 192 comes with Okifont software. This print font editor includes five downloadable character sets. To create a character,

you draw on a grid. The software does the conversion and programming.

Other features on the 192 include a hefty 8K-byte buffer and a no-muss, long-life cartridge ribbon. The NLQ print is crisp and clean thanks to a 17 by 17 matrix. (Default quality uses 9 by 9.) While the 192 is not especially quiet (80 db on the PC Labs sound test), its noise is not irritating.

The Microline 192 has earned a place on the desktop. It's both slim and light, and while it's not truly portable it is certainly luggable. The renovation of the printhead, access cover, and print font makes the 192 a sturdy, useful printer. Okidata promises to retrofit its old 192s with better access covers and bails at the customer's request. It's nice to see a company that isn't afraid to say "we can do better," and then tidy up its old designs.

—Robin Raskin

MICROLINE 192
(Standard Version)

Because I've always been fascinated by tiny electronic wonders, the Okidata Microline series of printers appealed to me the moment I first saw them during *PC Magazine*'s 1985 printer survey. They certainly were (and still are) pretty little machines. It was only when I started putting them through the printer tests that my initial delight turned sour. If the hood of your Honda hatchback or the cassette door of your Sony Walkman behaved like the original Microline access cover, you'd feel that same disappointment—every time you picked it up off the floor.

I'm happy to say that the new, improved Microline 192 stays in one piece

THE DROP TEST

By nature a gentle man, printer reviewer Charles Petzold was uncharacteristically excited by the opportunity to drop an Okidata printer on the floor.

I am not by nature a destructive person. But when representatives from Okidata suggested that the Microline series of printers could survive a 1-foot drop on the desk, the temptation to perform such a test in the PC Magazine Labs was more than I could resist. After all, in my original review of the Okidata Microline 192, I was the reviewer who said that the printer's true home should be on display under glass at an industrial arts museum. To me, the printer just did not seem suitable for the rough-and-tumble environment of a real office or home.

I wondered if my former opinion was a mistaken perception based on the size and seemingly fragile construction of the 192. Does the 192 actually incorporate solid craftsmanship where it counts? Could I really judge a printer by its access cover?

Finally, there was no way I could avoid it. After working up some courage (and informing special projects editor John Dickinson of my intention), I started up the speed test, lifted the printer 12

inches above the desk with both hands, and—don't try this one at home, kids—let go.

The printer stopped running when it hit the desk, but started up again after I turned it off and on. It seemed to be working normally, although the print quality was a touch lighter than before the drop. Of course, such behavior is addictive, and I couldn't resist trying it again. The second time the printer kept running and the print quality was much lighter—as if the ribbon had been used for several years. I replaced the ribbon with no improvement. I felt bad after that and didn't have the heart to try it a third time. Unlike some people, I have never felt the urge to smash up computer equipment.

Since *PC Magazine* prefers to return intact, working equipment to their manufacturers rather than boxes full of mutilated pieces, the Labs do not normally conduct drop-tests on peripherals. Dropping only the Okidata Microline 192 is, itself, unfair. I really don't know how other printers would react to this brutal treatment.

Back up in the fourth-floor editorial offices, I couldn't find any Okidata 2410 users willing to let me do a similar test on their 74-lb. machines. Perhaps they had visions of the printer crashing through the desk and ending up clobbering an oscilloscope (or project testing editor Michael O'Cone) down in the third-floor PC Labs. Back at home, I looked at my IBM Graphics Printer and considered it. But, in the end, I decided that buying a new printer should be a matter of choice rather than necessity.

In my original review of the Okidata Microline 192, I said the print quality and speed were surprisingly good for a printer this small, and that is still true. The CSF 900 sheet feeder worked fine. The printer appears to be more solidly constructed than the original version. It can probably survive real-life environments as well as most other printers.

But just don't drop it, OK?

—Charles Petzold

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87, 1988, 1990, 199

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when printing, and that satisfies at least a minimum standard of printer operation. The troublesome access cover has been modified to include clips that make it stay on. It's pretty obvious that this is a retrofit because you can shift the cover a half-inch toward the front of the printer. But the clips make the cover stay put, and it's a welcome improvement.

Aside from the improved access covers, other more subtle changes now make the Microlines sturdier than the originals. The paper feeding is sufficiently better that I didn't have any problems with it. And while making these improvements, the Microline 192 (Standard Version) does not sacrifice any of the good features I noted in my original review. With default print quality, the Okidata 192 still hits about 100 characters per second. The near-letter-quality font looks good.

The only problem I had with the new Microline 192 printer was a minor and most unusual one: buckling of the printhead ribbon cable. Normally the cable runs from the left side of the case, lies flat on the bottom of the printer, and curls up to attach to the right side of the printhead. At one point, the cable buckled up at the left and prevented the printhead from moving all the way to the left margin. I have never seen that happen before in any printer. Straightening the cable out again solved the problem and it never recurred.

If you have an IBM PC, you'll probably

want the IBM version of the 192. While both the standard and IBM versions of the Microline 192 print the high-order IBM character set, the IBM version supports a superset of the standard IBM Graphics Printer control sequences and, more important, can handle a screen-dump if the DOS GRAPHICS program is loaded.

You can download fonts into both versions of the printer, but only the IBM version comes with software to help you out. The basic difference between them is the ROM chip, and Okidata will sell you a kit to convert either model to the other.

Last summer, the Okidata Microline 192 was just pretty. Now it's pretty, and it works too.—**Charles Petzold**

MICROLINE 193
(IBM Version)

The Okidata Microline 193 models are the wide-carriage versions of the Microline 192s. The 193s are the smallest wide-carriage printers to pass through PC Labs. The IBM-compatible version supports the IBM character set and IBM-compatible graphics and adds a few other control sequences for italic and correspondence quality.

The Microline 193 (IBM Version) comes with a box full of goodies including a platen-cleaning kit, a tractor feed, and a disk with downloadable fonts. Like the 192s, the 193 printers are fast and generally have good print quality. The unidirectional tractor feed is still easily twistable (as it was in the machine I tested last year's printer survey), but it gains stability when attached to the printer and it works well.

Another good feature of the Microline 193 is the manual. Okidata has picked up the tradition originated with the Epson FX-80 of supplying manuals that actually teach you something about printers. Using

lots of BASIC code, diagrams, and enlarged drawings of dot patterns, the Okidata 193 manual guides you, through the control sequences. Although the manual loses steam when it comes to the sections on all-points-addressable graphics and downloadable fonts, you'll still find enough to get you going.

The IBM version of the 193 also comes with a font disk, so you can take advantage of the downloadable font feature without resorting to doing the programming yourself. (For some people, this is a blessing, but for others, it takes all the fun out of it.)

For those times when sending the control sequences to the printer is inconvenient, the 193 will let you control many of its features from the front panel. The nice thing about Okidata's implementation of this menu mode is that it's interactive: The 193 prints your selections as you choose them.

I had said in my original review that during graphics printing, the Microline

193 "wails as if in dire pain." Does it still? When I started up the graphics test, a visitor to the PC Labs was standing about 10 feet away. Without prompting from me, he commented, "Oh, that sounds painful." I accept the comment as confirmation of my original opinion.

The optional Okidata CSF 900 Cut Sheet Feeder can be used on both the standard-carriage Microline 192 and the wide-carriage Microline 193. At first, this does not seem possible. The trick is that the

THE MICROLINE SHEET FEED OPTION
Back at the drawing board, Okidata also patched up serious differences between the Microline printers and their sheet feed attachments.

PC *Magazine* reviewed cut sheet feeders late last year (see ''Sheet Feeders: One Page at a Time,'' *PC Magazine*, Volume 4 Number 24). Among those tested was the Okidata CSF 900 for the Microline 192 and 193 printers. At $229, not only was it the most inexpensive sheet feeder that PC Magazine Labs tested, but one of the best.

Now that the Microline printers have been enhanced (and the already reliable CSF 900 has undergone some subtle but significant changes, too), the result is an even better printer system than the one evaluated in Volume 4 Number 24.

Simply attaching the CSF 900 to a new Microline 192 immediately eliminated the access cover annoyance, the pin-feed paper feed problem, and most of the other flaws of the original 192.

In my first review of the CSF 900, the only time I ran into a problem was when the output hopper got full. At about 140 pages, the printer started complaining loudly and finally refused to feed paper. This didn't seem like much of a problem considering that Okidata only claims a capacity of 120 sheets for the output bin.

Nonetheless, changes in the CSF 900 have eliminated even this drawback. PC Magazine Labs tested four of the sheet feeders this time through—one with each 192 and 193. In two of the tests, the CSF 900 handled about 170 sheets of paper in both input and output bins with no problems. In a third test, only one paper jam occurred in a bin full of paper.

One reviewer had recurring jams and crumpled pages, but this seemed to be caused by the paper itself. A close look at the paper revealed that it was curling up and getting caught on the plastic paper guide of the sheet feeder. When we flipped the paper so that the curl worked with the printer rather than against it, the problem disappeared. But the problem could be avoided if the paper guide were designed to anticipate the problem and guide the paper correctly anyway.

This particular unit appeared to have a problem. Unlike the supposedly identical CSF 900s tested, it insisted on announcing itself with an annoying squeak that would not be appreciated in an office.

One point that all reviewers agreed on was that the CSF 900's best feature is its ease of installation and simplicity of use with the small-carriage 192s. But a significant complication crops up in installation with the wide-carriage 193s.

In order to work with the wider printer, the sheet feeder has an adjustable mounting bracket that needs to be taken apart and restructured to fit on the wider carriage. This is not an easy task, as reviewer Charles Petzold found out.

''To adapt the CSF 900 for the Microline 193, you must remove three screws and reorient the mounting bracket,'' says Petzold. ''Fortunately, you'll only have to do it once. Although two pages in the manual are devoted to this initial installation, they are not enough. I finally reassembled it more by instinct than by following the instructions.''

Once you've mastered the assembly, the sheet feeder and tractor feed can attach and detach from the printer very quickly. According to Okidata, this section of the documentation has already been rewritten to address the problem.

In my first look at the CSF 900, I concluded that the additional investment in the sheet feeder was well worth it for anyone who owned a Microline 192 or 193. I still stand by that conclusion, but if you have the 193, you might like to let your dealer set it up for you.

—M. David Stone

FACT FILE

CSF Sheet Feeder
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2840 (in N.J.)
List Price: $229
In Short: One of the cheapest and best cut sheet feeders *PC Magazine* has tested. Its performance is further enhanced by the ''fixes'' in the Microline 192 and 193 printers.
CIRCLE 654 ON READER SERVICE CARD

■ OKIDATA MICROLINE PRINTERS

sheet feeder has to be partially taken apart and reconstructed to clamp onto the wide carriage. (The feeder is still limited to 8½-inch wide paper, however.)

The Microline 193 and CSF 900 make a good versatile combination. The quick switch between them is quite painless, and you'll easily get the procedure down to a matter of seconds.—**Charles Petzold**

MICROLINE 193
(Standard Version)

After a bad case of growing pains, the new Microline 193 (Standard Version) has matured into a printer with a number of good new features. The annoyances that plagued the last version of the 193 have been eliminated.

While still much lighter than earlier models, it is no longer a flimsy machine. The print quality is consistently clean and crisp, with the exception of the "half dot enhanced" mode, which was ragged.

Originally, the 193 was offered factory-configured for either Okidata's own protocols or with IBM graphics printer protocols. But the company offered no retrofit package comparable to the old Plug 'n' Play kit that let users add IBM graphics emulation to the non-IBM version. That limitation has now been corrected.

One of the first things I did on the 193 was to look and see if the DIP switches were any easier to get at than on my old 92. Surprisingly, there aren't any. Oki has replaced the old hardware-selected functions with menu-selected software commands, which are retained in battery-backed-up memory until you change them or the battery needs replacement.

The optional tractor assembly can be installed in at least two ways, but if you don't do it correctly, the acoustic cover doesn't fit. This problem results from poorly written documentation, which Okidata says is being revised.

Okidata's new sheet feeder for the 192/193 printers, however, is impressive. Once set up the sheet feeder is easily attached and can be traded with the tractor in a minute or less. It held about 130 sheets of paper and fed them without a hitch. Although it won't feed envelopes or collate multiple-sheet documents, this accessory goes a long way toward bridging the gap between a small desktop printer and some of the bigger office machines.

Despite its lighter construction, the new 193 is a decent printer. As a longtime Oki owner, it's nice to be able to recommend one to my friends again.—**Jim Forney**

M. David Stone, Vincent Puglia, Robin Ruskin, and Jim Forney are frequent contributors to PC Magazine. Charles Petzold is a contributing editor.

POWER PER·FOR·MANCE: NINE PROGRAMMABLE MAIL-MERGERS

These nine "programmable" mail-mergers bring database management techniques to bear on mass-mailing tasks. But no one package combines a full range of features with ease of use.

I f mail-merge programs could do no more than insert names and addresses and pop boilerplate text into business form letters, plenty of office managers and other PC users would still consider them remarkable timesaving tools. What many, perhaps most, users don't know is that many mail-mergers offer far greater capabilities than these. They have layers of muscle that most of us never even see, much less take advantage of. The most sophisticated ones are true power-user programs that will

take on a wide range of tedious operations.

Mail-merge programs often perform simple calculations, allowing you to prepare invoices or customized job estimates. Many pause at each new letter to accept input from the keyboard. Some can sort your mailing lists. Some can even test your data file for certain conditions, such as a certain ZIP code, and then insert customized text.

These "conditional" commands in mail-merge programs actually qualify them as mini programming languages that offer you much of the power and many of the pitfalls normally associated with computer programming. On the plus side, you gain flexibility, including the means to automate complex merge operations for execution by less experienced personnel. The disadvantage is that for each merge run that you set up, you have to perform the traditional and time-consuming rituals of programming: planning, writing, and debugging. But if you need to squeeze real horsepower out of your mail-merge operations, prepare complex personalized mailings, or automate repetitious reports and can find your way around a simple script file, the programs reviewed in this article can help you get the job done.

Because mail-merge straddles an ill-defined border area between database management and word processing, these programs don't always fit a neat product category. Usually, they are features of word processing pro-

grams—the case with eight of the nine programs reviewed here—but they can also be integrated with a database package that works closely with a word processor (like the *Perfect Writer/Perfect Filer* team included in this review roundup). In our survey, we looked for and evaluated the following features:

Help with data entry. Unlike a database management program, which usually prompts you for the data it expects, a mail-merge program often presents you with a blank screen and asks you to enter the data freestyle. If you inadvertently omit a piece of data or a comma, you can throw your whole merge run out of kilter. We looked for programs that have special data-entry screens and that prompt for each item.

Data formats. The most common data format is "comma-delimited ASCII," a straight ASCII file in which the data items are separated by commas. While creating such a file can be a tedious task, many database programs can export data in comma-delimited format; they speed data entry by letting you add a database program to your mail-merge system.

Translation utilities. If the mail-merger doesn't use comma-delimited ASCII files, does the program offer an easy way to translate data from other programs?

Omits leading or trailing blank spaces. Another way to make data entry a bit easier if you have to enter the data freestyle is to line up your data in a spreadsheetlike grid with all of the commas aligned. However, this method will only work if your mail-merger can throw out the leading or trailing blank spaces.

Sorting. Can the program sort your data file?

Closes gap when field is missing. If a data item is missing, such as a company name in an address, does the program leave a blank line where the missing field would normally be placed, or can it close the gap?

Input from the keyboard. Can the mail-merger pause to ask the operator for input, such as the current date or the price of an item?

Print-to-screen option. Can you preview the merge output on-screen before you send it to the printer?

Spooling. Can you edit another document while the merge run is printing?

System date. Can the merge program use the DOS date in the printed documents?

Number formats. Can you specify decimal places or put dollar signs or commas in numbers from the data file?

Three-up or three-across labels. Can you print labels three in a row?

AND/OR operators. Can you create compound IF statements using AND and OR operators?

Merging boilerplate inside a paragraph. Can the program merge boilerplate into an existing paragraph, or does merged text always have to start a new paragraph?

Merging ASCII files. Do you want to include part of a *1-2-3* spreadsheet in your monthly budget report? If your mail-merge program can read in ASCII files, you can "program" a merge run that will read the ASCII version of your spreadsheet and insert it into your report.

Widow and orphan control. It's important that your merge run doesn't end a paragraph at the top of a page or begin a paragraph at the bottom of a page.

Math operations. Can the mail-merger do math?

Command files. Can you automate a repeated merge so that the operator enters only the name of the master document and the name of the data file?

If your mail-merger includes these power features and you're not using them, the reviews and features tables that follow should give you a clue as to what you're missing. If your office doesn't even use a mail-merge program, read on about some of the most efficient timesaving programs around.

WORDSTAR PROFESSIONAL MAILMERGE

MicroPro International Corp.'s original *MailMerge* is the granddaddy of the merge program genre. Even today, the program packs quite a wallop, performing both simple and complex merge tasks with an agility that belies its age. Originally sold as a standalone program, *MailMerge* is now part of the *WordStar Professional*, Version 3.31, package, which includes *WordStar*, *MailMerge*, *CorrectStar* (a spelling checker), and *StarIndex*.

MailMerge uses a simple device for merging data with text. At the heart of this device is the master document, which contains commands that control the Mail-

Merge run and a template for insertion of data. A master document for the classic form letter would include an internal address template composed of variable names that would look like this:

&Mr~Ms& &Firstname& &Lastname&
&Title&
&Companyname&
&Address1&
&Address2&
&City&, &State& &Zip&

This template sets up the format for the incoming data file. Note that each variable name is set off by ampersands. Anytime *MailMerge* encounters a word enclosed by ampersands, it looks for some live data to substitute. If you include a variable name in the middle of a paragraph, *MailMerge* will reformat the paragraph in accordance with its original margins and spacing. This technique, or something very similar to it, is the basis of most mail-merge programs.

But that's only the beginning of *Mail-Merge's* tricks. The program includes a procedural language that lets you set up complex merge runs; you can, for example, insert different paragraphs for clients in different regions. To control this kind of "conditional" merge run, you embed control commands in your text which *Mail-Merge* can recognize as such. *MailMerge* can recognize them as commands because, consistent with *WordStar's* dot command format, they begin with a period and appear flush with the left margin. A special IF command can test incoming variables using conventional programming opera-

tors like greater than and equal to. *Mail-Merge* also lets you combine conditional commands using AND and OR operators. Depending on the result of each test, *Mail-Merge* can skip to different sections of the master document.

If you string a series of *MailMerge* dot commands together, you can create a *MailMerge* command file that can automate the production of complex documents and repetitive reports. Suppose, for example, you need to send a monthly income report to a number of managers in your firm and you wish to incorporate data from a spreadsheet. *MailMerge* lets you set up a command file that prompts the operator for the names of the necessary files, including the mailing list file, the master document, and the ASCII spreadsheet file. *MailMerge* then prints reports for everyone on your list. Command files are also useful if you want to "filter" your data, producing, for instance, a mailing list of customers with a certain ZIP code.

MicroPro's *MailMerge* does suffer from a few limitations, which could be significant, depending on your needs. It has no math capability. And because the dot commands must be flush left, it cannot insert boilerplate or perform conditional testing within a paragraph.

Further, *MailMerge* offers no significant help in creating *MailMerge* data files. Unless you use another program to help with data entry, you have to use *WordStar's* "nondocument" editor to create the necessary ASCII file. Because you can't adjust the tab settings on this editor (they're

preset at every eight characters), data entry is even more tedious and error prone than with an editor that offers adjustable tabs.

Finally, when you're printing a *Mail-Merge* run, you can't edit another *Word-Star* document. *MailMerge* takes control of the computer until it's done printing. However, you can preview your merge output by sending it to disk and then scanning the resulting file.

Still, *MailMerge* remains a powerful contender among mail-merge programs. Like *WordStar* itself, this classic program has lots of life left in it.

WORDSTAR 2000 MAILMERGE

WordStar 2000's MailMerge is a kissing cousin of MicroPro's original *MailMerge*. Sold as part of the basic *WordStar 2000* package, this *MailMerge* shares many of the talents and limitations of its older namesake, but it adds a few power features of its own.

Like the original *MailMerge*, *WordStar 2000's MailMerge* includes a powerful command language that has conditional statements and programming-style operators such as AND, OR, and NOT functions. Also like *WordStar's MailMerge*, *WordStar 2000's MailMerge* accepts the comma-delimited data files exported by most database software.

The main difference between the two *MailMerges* is in the way they produce master documents. With *WordStar 2000*, instead of typing *MailMerge* commands into the body of the text, you select the appropriate command from a *MailMerge* menu. *WordStar 2000* then automatically places the command in text for you. Like other *WordStar 2000* formatting commands, the *MailMerge* commands are invisible unless you tell the program to display them.

The advantage of this menu-driven approach is that you don't have to remember a lot of command abbreviations like F1 for FILE INSERT, so you're less likely to produce syntax errors. However, you still have to remember where to embed the commands. We recommend that you follow the examples in the manual closely to make sure that you implant all the com-

With WordStar Professional's MailMerge, *you can use dot commands to test incoming ZIP codes. The program then inserts different boilerplate into your text depending on the ZIP code.*

WordStar 2000's version of MailMerge includes an ancillary program called MailList, which, among other things, has a data entry template that greatly eases data entry chores.

mands in the correct order. One limitation common to both WordStar 2000's and WordStar 2000's MailMerges is that commands have to be placed flush with the left margin, so you can't include a conditional command in the middle of a paragraph.

Another plus for WordStar 2000's MailMerge is that it offers built-in print spooling for your mail-merge run. However, since this function greatly slows down the program's already less-than-speedy performance, you'll probably want to start your merge run when you don't need your computer for other tasks.

The deluxe WordStar 2000 Plus package features a handy program called Mail-List that makes the chore of data entry a whole lot easier. MailList comes with a template that prompts you for the usual mailing list data, as well as some blank fields for comments. Once you enter the names and addresses, you can sort them or search for particular records with just a few keystrokes. You can print labels in a variety of formats, also with just a few keystrokes. And of course, you can use your MailList database as input for WordStar 2000's MailMerge.

While MailList is certainly a nifty little program, it could stand improvement in a number of areas. First of all, it sorely needs some kind of file-translation capability. If you've already compiled a computerized mailing list using a different program, there is no way to import the data into MailList. And while MailList lets you apply a "filter" for viewing data so that, for example, you select records with the same ZIP code, it cannot write that filtered mailing list to disk. If you want such a filtered mailing list, you can produce it by creating a MailMerge command file that sends the output of the merge run to disk, but this means you have to do an entire merge run every time you want to filter a list by the same criteria. Also lacking in this mail-merger is a match feature.

Even with its limitations, MailList can greatly simplify the most common mailing list management chores. And the way it automates label production has to be seen to be appreciated. If mailing list management is a high priority, WordStar 2000 Plus might be the program for you.

NEWWORD 3

NewWord 3, which began life as a WordStar clone and then went on to develop its own personality, still expresses its roots by using WordStar-style embedded dot commands to control its mail-merge facility.

Up to a point, the commands are interchangeable with those of MicroPro's classic MailMerge. But when you get to the more complex commands, NewWord 3 goes its own way. It ends up being more powerful in some areas than its famous role model, although it suffers from some deficiencies as well.

Like MailMerge, NewWord 3 includes a procedural mail-merge control language that uses IF statements to test incoming data. This powerful language also has a math command that will do calculations for each record in your data file, so that you can prepare invoices and statements.

If you've had much programming experience, you'll recognize NewWord 3's formatting masks, which are similar to those in BASIC's PRINT USING statement. These allow you to align incoming variables within tables and to make sure that your dollar signs appear in the proper places next to the numbers.

NewWord 3 lets you pull the DOS date into your documents at print time. And you can use the program's current page and line numbers in your processing.

One big improvement over WordStar's MailMerge is NewWord's ability to send

the print output to disk; you can use the DOS PRINT command for background printing of a large merge run.

Still, *NewWord 3*'s merge program shares some of *MailMerge*'s shortcomings. Because its dot commands have to be flush left, you cannot insert boilerplate in the middle of a paragraph. And since *NewWord 3*, like *WordStar*, doesn't offer variable tab settings in its nondocument editor, creating ASCII data files is more difficult.

NewWord 3 also falls behind *WordStar*'s *MailMerge* in one important area. *WordStar* retains the spacing and margins of your master document when it inserts variables and boilerplate text. *NewWord 3*, on the other hand, realigns the merged text to match the program's default margins and spacing unless you specifically override the defaults. Thus, for instance, if *NewWord 3* inserted live data into an indented paragraph, it would reformat the paragraph to match the default margins. It would only retain the indentation if you included a dot command resetting the margins for that particular paragraph.

Nonetheless, *NewWord 3* clearly rivals *WordStar*'s *MailMerge*. It has most of its power, along with extras like its math command and print-to-disk function. Although it was not yet on the market at this writing, it should be by the time you read this. If you're shopping for a powerful mail-merger, *NewWord 3* is definitely worth a close look.

MICROSOFT WORD

Because *Microsoft Word*, Version 2.0, speaks the language of picas, points, and inches as well as columns and lines and be-

cause of its formidable formatting talents, it has a loyal following among those who need to fine-tune the appearance of the printed page—especially those who have access to laser printers.

It's no accident then that *Microsoft Word*'s mail-merge program offers those same advantages. *Microsoft Word* takes in stride formatting feats that other merge programs find daunting. That's because *Microsoft Word* preserves the formatting and fonts in your master document. You never have to worry about changing the margins, line spacing, or fonts in your boilerplate text. They automatically change to match your master document. If you want your variables to appear in a special typeface, simply assign the typeface to the appropriate variable names. Or if you want your variables to line up in neat tables, just align the variable names using *Word*'s tab settings, which specify left, right, center, or decimal alignment.

Word's built-in column formats also simplify the often-maddening task of printing mailing labels in multiple columns, the so-called two-up and three-up formats. *Word*'s manual includes easy-to-follow instructions for setting up multiple column labels that can take a lot of pain out of the process. (If you use an Epson MX series printer, the instructions won't work. You can save yourself time and frustration if you call Microsoft's technical support and ask for the simple but not obvious fix.)

Variables and commands are embed-

NewWord 3's math command (.ma) makes it easy to create custom invoices. In this example, the program calculates the total due from the incoming data and prints in the proper column.

Microsoft Word allows precise control over the format of your merges. This split screen shows a merge master document and a data file. Merged, they produce a table with all of the data neatly aligned on the tab stops.

ion illumination.

ded in the master document, separated from the main text by double-caret brackets << and >>. Unlike the dot commands in MicroPro's *MailMerge*, the commands don't have to be flush with the left margin; boilerplate text and conditional commands can appear in the middle of a paragraph.

Microsoft Word is also ahead of the pack in its approach to organizing data files. It accepts the common comma-delimited format produced by many database packages. But it also accepts *Microsoft Word* document files, in which the data items are aligned by tab stops. This file format greatly simplifies data entry because you hit a single key, the Tab key, after entering each data item. Also, because the data is aligned in columns, it's harder to inadvertently omit an item.

Nonetheless, *Microsoft Word*'s mailmerger isn't perfect. Perhaps the most troublesome drawback is the lack of an easy way to preview merge output. Since it

can take several test runs to debug the command sequence in a master document, especially if you use complex conditional statements, plan on using up quite a bit of paper for testing.

Microsoft Word's merger eats up computer time as well as paper. Once your merge run is ready to go, there is no way to send the output to a disk file for later printing. Nor will *Word*'s built-in print spooler manage the merge run. So don't start a lengthy merge run when you need your PC for other tasks. *Microsoft Word*'s merger wants the computer all to itself.

Less seriously, *Microsoft Word* lacks math and sorting abilities, so you'll have to invest in a database program if you want to send out invoices or do batch math calculations.

Despite its drawbacks, there's a lot of power in *Microsoft Word*'s merge program. If you need heavy-duty control over the format of your final printed documents, it's a serious contender.

DISPLAYWRITE 3

DisplayWrite 3 is a full-featured word processing package from IBM that includes a powerful mail-merge capability. You can build data files directly, since *Display Write*'s own conventions for naming variables in a data file, or merge *DisplayWrite* text files with data from files created using programs like *VisiCalc*, *1-2-3*, *Multiplan*, and *dBase II*. *DisplayWrite 3* lets you incorporate addition, subtraction, multiplication, and division into your text and tables, as well as into your merged fields. The program offers a menu selection for incorporating variable names into your text and enclosing them in exclamation points (!name!).

The package itself is popular—or at least widely distributed—in large corporations where the choice of PC software was probably left to someone with a high tolerance for technical jargon, or whose selection is influenced by those three little let-

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MAIL-MERGE WISH LIST
What do power mail-merge users really want? For starters, speed, flexibility, ease of use, and freedom from cryptic codes.

In reviewing mail-merge packages we found that they all fall short in some way or another. Here's our conception of the ultimate mail-merge product that incorporates all the features on our wish list:

The ideal package won't limit us to the ten or so fields that commonly appear on a mailing label or phone list. We want to be able to add our own defined fields of any length (or at least up to 128 characters)—including a full sentence—and to merge-print that sentence field for a more personalized form letter.

We also want to be able to sort by any of these fields, including by multiple criteria (such as company and city). The ultimate mail-merger should be able to select records that match a string (name=Smith), fall within a range (ZIP between 94100 and 95000), and let us specify by IF/AND/OR criteria (IF balance>0 AND date>12/1 OR date <12/15, then . . .).

We'd like a mail-merger to make it easy to design printout formats and position merged data anywhere on the page—including three-across labels. The ideal package would also let us merge data into paragraph text and, if necessary, automatically reformat the paragraph at printout time to match selected margins.

Few circumstances are as irritating as getting half-way through printing a long series of letters or labels, being stopped by a paper jam, and then discovering that you must either start the print job over from the beginning or delete the already-printed records from the file. Our plea is for a package that lets us resume an interrupted series of letters or labels at whatever point we choose.

Of course, with the sophisticated word processors now available, our wish list includes a mail-merger that can handle all the text styles our equipment is capable of producing (for example, print-

ing some fields in boldface or italic). If several fonts are available, we want those, too.

The last item on our list concerns merging a text file with data from a variety of sources—comma-delimited ASCII, DIF, or SYLK formats from spreadsheets and databases. We want to be able to handle data that comes from any type of file format used in daily business on the PC.

Perhaps most important of all, the program should be free of cryptic codes and complex programming calls. How ironic that one of the most commonly used applications can all too often be one of the most (unnecessarily) complex to work with.

Of course, no single mail-merge application requires all of these features at one time, but overall, these are the features we find we need the most. Perhaps one day we'll see a package that includes them.—**Diane Burns and S. Venit**

ters: IBM. The program is menu-driven, but the menu prompts are often too cryptic or technical to understand unless you have already read through the two-volume, 600-page manual. The package does not include either an on-disk tutorial or sample files. Compared with the other programs reviewed here, *DisplayWrite 3* perhaps the longest learning curve. A formal 1- or 2-day hands-on training session would be well worth the investment for anyone buying this package.

One example of *DisplayWrite 3*'s long learning curve is in merging text with a spreadsheet or database file. A submenu prompts you to identify the file format as fixed-length, BASIC sequential, DIF, SYLK, PDS, or *dBASE II*. Five lines at the bottom of the screen identify the corporations that own these trademarked names, but actual program names are not included here or on the help screen. You need to search the manual to discover, for example, that *1-2-3* and *dBASE* files store files in DIF format. To some this may seem like common knowledge that is not worth a second thought, but it would be handy if the screen prompts offered more help to nontechnical users. *DisplayWrite 3* is the kind of program that can keep an in-house maven happily answering distressed users' questions forever.

If you are not using data created by another program, *DisplayWrite 3* makes setting up a data file a bit simpler—perhaps

even simpler than some of the other programs, in which you must keep track of commas, quotation marks, and carriage returns. You simply type the field name (as in the syntax shown below) on each line followed by the field entry:

```
!name! Mr. J. Allen
!company! CBA Co.
!address! 123 Main
!city! Sacramento, CA 99999
```

Since every record needs the same set of labels, you can simplify this process by typing in the basic label set once, duplicating it for every record, and then going back and filling in the variable data. You can save disk storage space by keeping field names short. Each record must be typed on a different page in the data file.

You can set up conditional text statements based on whether a field is empty or not. For instance, you can tell the program "if the state field is empty, print 'NY' " by entering **/If Empty, STATE/N-Y/End If/)** or "if the amount field is not empty, print 'Payment due upon receipt of invoice' " by entering **/If Not Empty, AMOUNT, Payment due upon receipt of invoice/End If/**. You can also specify combinations of conditions for a single field, such as "if the field is empty, print 'Your account is now overdue'; if the field is not empty, print 'Thank you for your payment.' "

Although *DisplayWrite 3* is powerful in that it lets you take advantage of math functions and merge files created by some spreadsheet and database programs, some of the features it's missing may be too critical to live without. You cannot print three-

across labels in *DisplayWrite 3*. Nor can you sort records or select subsets of data files to be merged. You cannot set up conditional statements based on numerical values entered in a field ("if the value is 1 . . . " or "if the value is greater than x . . ."). You cannot merge comma-delimited files with *DisplayWrite 3* text files. Also, *DisplayWrite 3* files are stored in EBCDIC, rather than ASCII format. The format won't matter to most users, but it could make a difference if you need to telecommunicate files to other stations that require ASCII character data.

> ■ *DisplayWrite 3* can keep an in-house maven happily answering users' questions forever.

DisplayWrite 3's mail-merge features are just not sexy enough to compensate for its outdated user interface. Its special features are most likely to appeal to users who work primarily with spreadsheets and databases and who need to print data from these files in other formats, since *DisplayWrite 3* can serve as a report writer for these other programs. If you have not already invested heavily in *DisplayWrite 3* as a word processor, some of the other mail-merge packages reviewed here would probably prove to be more immediately productive.

With DisplayWrite 3, complexity translates into flexibility. You can, for example, merge files in a variety of formats, like DIF, SYLK, and dBASE II, into the same text file.

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Diskit 2 is easy to install. You just plug it in, type "INSTALL" and you're up and running.

Nice to drive, but tough to park.

(That's about the same time it would take to scan the first paragraph of the Bernoulli manual.)

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For more information, see your local dealer or call IDEA at 1-800-257-5027.

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WORDPERFECT

At first glance, *WordPerfect* from Satellite Software International (SSI) would seem to lack a programmable mail-merge feature, the prerequisite for inclusion in this collection of reviews. Unlike the other mail-merge programs in this survey, *WordPerfect* doesn't offer embedded IF . . . THEN commands that can test variables in the merging data file and direct further processing.

Yet *WordPerfect* can do conditional merges all the same, thanks to its powerful macro capability. Not only can *WordPerfect*'s macros record command and text sequences to be recalled at a few keystrokes, they can also make simple decisions. So, if you use macros to invoke your mail-merge, you can create automated, "conditional" merge runs that rival anything you can create with *WordStar*'s *MailMerge* or *Microsoft Word*.

The macro approach has several distinct advantages over the conventional embedded command approach. Because you record a *WordPerfect* macro by actually performing the commands, the macro is self-verifying: you can see what it does while you're composing it. This design eliminates the need for a lengthy separate debugging step in preparing your merge procedure. And since the macros use *WordPerfect*'s regular commands instead of a special set of embedded commands, you don't have to learn a special "programming language" to prepare complex merge runs.

One drawback of the macro method is that if you make a mistake while recording a macro, or if you need to revise an existing macro, you have to start recording all over again, right from the beginning. You can solve this problem, however, if you invest in SSI's new $129 *WordPerfect Library*, which should be available by the time you read this. The desktop organizer with a pop-up calculator and calendar, includes a program that allows you to edit *WordPerfect* macros, along with other handy tools such as a clipboard and a program editor.

If you're familiar with macros offered by other programs, you may be wondering how *WordPerfect*'s macros can "make de-

cisions." This is how it works: *WordPerfect*'s conditional macros are three-part macros that use the program's search command. The first macro invokes the search, branching to a second macro if the search is successful and to a third macro if the search fails.

Although the manual doesn't explain how to set up a conditional merge run using macros, it's not hard to figure out once you understand how the macros work. Since you can "chain" *WordPerfect* macros together so that one macro invokes the next, you can set up a series of chained macros that control a conditional merge run. The first macro would start the merge run, and then a conditional search macro could insert different boilerplate files depending on the results of the search.

You can also create *WordPerfect* macros that help you with data entry, probably the most onerous chore in most mail-merge systems. For instance, I was able to create a set of macros that prompted me for the names and addresses in my data file as if I were filling in a form on-screen. If you use the macros together with the program's math feature, you can automate the production of invoices and other merged reports that require calculation.

Another plus for *WordPerfect*'s mail-merger is its two-stage structure. Instead of sending output directly to the printer, it sends the merged document to the screen as a regular *WordPerfect* document. This way, you can quickly review merge results before you print and use *WordPerfect*'s built-in print spooling to free your computer for other tasks while the run occurs.

Still, *WordPerfect*'s mail-merger does not earn a perfect score. One problem is that the program employs a proprietary data format instead of the more convenient and commonly used comma-delimited data files. With the *WordPerfect* format, you have to press a function key after typing each data item. Also, each data item occupies its own line in the file, a format that makes it difficult to proofread your data file. Happily, *WordPerfect* can easily translate comma-delimited and DIF files into its own data format, making it easy to import data from database programs and spreadsheets.

Another minor inconvenience in *WordPerfect*'s mail-merger is that it doesn't use

WordPerfect macros let you easily customize invoices. In this example, you can merge the master invoice in the top window with the data file in the bottom window and then execute the math command to print the invoices.

PC LABS Mail-Merge Programs: Summary of Features

Program name	List price	Data formats	Help with data entry	Translation utilities	Omits leading or trailing blanks	Sorting	Closes gap when field is missing	Input from keyboard	Print-to-screen option	Print spooling	System date	Number formats	Three-up labels	AND/OR operators	Merges ASCII files	Merges within paragraph	Widow/orphan control	Math operations	Command files
DisplayWrite 3	$450	Fixed-field ASCII			●	●				●	●					●	●		●
Microsoft Word	$395	Comma-delimited ASCII, proprietary						●	●		●					●	●		
NewWord 3	$349	Comma-delimited ASCII			●			●		●				●	●	●	●		●
Perfect Writer Perfect Filer	$199 Writer $199 Filer	Proprietary	●	●	●	●	●					●	●	●					†
SuperWriter	$295	Fixed-field ASCII, proprietary	●		●	●		●		●	●			●	●				●
WordPerfect	$495	Proprietary			●			●	●	●	●	●		●	●	●	●		●
Word Result	$99.95	Proprietary	●	●	●	●	●	●				●		●	●	●		††	●
WordStar Professional	$495	Comma-delimited ASCII			●			●		●				●	●	●	●		●
WordStar 2000 WordStar 2000 Plus	$495 Basic $595 Plus	Comma-delimited ASCII			●	●		●		●	●	●		●	●	●	●		●

From DIF SYLK .DBF   From DIF ASCII   †From Perfect Calc   ††With Calc Result   ● means yes

descriptive variable names such as "zip-code." Instead, WordPerfect refers to a variable by its position in the data record. Thus, if the ZIP code were the fifth item in your data records, you would refer to it as "F5" for "field number 5."

WordPerfect does, however, score well on most of our tests and has a nearly complete complement of features. Its creative use of macros makes WordPerfect's prodigious power accessible even to nonprogrammers. WordPerfect has justly earned a reputation as one of the most powerful, well-designed word processors in the PC marketplace. Its mail-merge feature more than lives up to that reputation.

PERFECT WRITER AND PERFECT FILER

Perfect Filer is a flexible, easy-to-use database program. Used in conjunction with Perfect Writer, it can also produce mailing labels, form letters, and other merged documents. With clear prompts and pop-down menus, this set of programs is one of the easiest to learn and use of all the packages reviewed here, largely because its menu selections help you perform functions for which other packages require embedded programming codes, letting you avoid memorizing commands and debugging keyed entries.

A simple mailing label created in Perfect Writer consists of field names enclosed in angle brackets. For example:

```
<first.name> <last.name>
<company>
<street>
<city>, <state> <zip>
```

To print labels, you open a Perfect Filer data file and use the cursor keys to select Print Labels from the main menu. The screen then prompts you to enter the name of the Perfect Writer boilerplate you want to use in printing the records, the number of lines from label top to label top, the number of labels across the page, and the number of spaces from the left edge of one

column to the left edge of the next. In other words, the same boilerplate can be used to print one-column, two-column, or three-column labels of any size.

You create boilerplate text using *Perfect Writer*; *Perfect Filer* controls the merge functions. *Perfect Filer* incorporates most of the features you'd want in a simple file package, including the ability to sort records using up to nine sort keys, to select records by comparing field values with selection criteria, and to enter data through on-screen forms. You can define up to 128 fields per record; the number of records you can build is limited only by available disk space. You can store up to 16 different files on a single floppy disk, although the manual recommends that you use one disk per file unless your files will remain small.

Data entry forms are easy to create by simply entering underscores and (optional) labels for each field. Once you have arranged the fields on-screen and opted to begin defining the fields, prompts appear to guide you. One prompt asks you to name the field, another asks, "Will the field contain only numbers?" You can set selection criteria to match a string of characters (including wildcards) or to fall within a numerical range (equal to, not equal to, greater than, greater than or equal to, less than, less than or equal to). You can create the equivalent of an IF ... AND statement by setting up selection criteria in more than one field—ZIP codes beginning with 941 and salary greater than $25,000, for instance—but there is no IF ... OR equivalent in *Perfect Filer*.

One especially nice feature of the *Perfect Writer/Perfect Filer* combo is its ability to identify selected groups of records by name and to store names for up to 16 different record groupings per file. Once a group is defined and named, you can make a simple menu selection to identify those records for printing. An address record that is included in three different groups named "California," "Regular_Account," and "Jan_Sales," for example, would receive all general announcements mailed to California residents, the special offers mailed to regular account customers, and an invoice at the end of January. You can also set up temporary selection criteria at the time of printing.

You cannot include formulas in *Perfect* fields, but you can convert data from the *Perfect Calc* spreadsheet package into *Perfect Filer*. If, for example, you make all your record entries in *Perfect Calc*—say, to calculate invoice totals—you can then convert the spreadsheet data to *Perfect Filer* for it to generate invoices. Unfortunately, you cannot convert comma-delimited files from other vendors' programs for use with *Perfect Filer* because the *Perfect* series stores data records in a proprietary format.

The manuals for the *Perfect* packages are well illustrated and easy to read and reference. Each book begins with a simple tutorial, follows with chapters describing each of the program's major functions, and ends with a complete set of practical examples of business applications (some of which are included as sample files on the program disk). The pages are attractively

designed, and the manual is bound like most of the soft-cover computer books you see in bookstores. The result is a high-quality guide to operations that eliminates the irksome necessity of buying how-to books from independent publishers and mercifully provides all the answers in one handy volume.

Anyone whose data isn't already tied up in some other program ought to consider the *Perfect* set for mail-merge applications. It's much easier to learn and use than most, and it incorporates almost all of the features you'd look for in a mail-merger.

SUPERWRITER

SuperWriter, Version 1.03's mail-merge feature has plenty of power, but getting it to work takes perseverance, skill, and luck, not to mention an occasional call to


```
───FILER SELECTION MENU───
  Add new records
  Review or edit records
  Define a group of records
  Sort records
  Merge a form letter
  Print labels
  Generate a list
  Transfer records to/from Perfect Calc
  Build a record form

  Exit Perfect Filer


 How many labels are there across each page?

Perfect Filer Version 2.08   (c) 1984 Perfect Software, Inc.
                       Press ESC for the menu.
```

Perfect Writer/Perfect Filer's easy-to-use menu system makes setting up merges a snap. You print three-across labels by simply following the prompts and typing in how many labels across you want.


```
«But you don't have to take our word for it. Satisfied
customers in «City» include: «lline 1 '$004 insert»
discount quoted for a '$007 insert allowable option'
size 94444  insert discount bug

To introduce you to our service, we'd like to make you a special»
introductory offer. We will order your first 5 information
queries for only $150. 50 per cent off of our regular service. We»
also have similar discounts for high volume query purchasers.»

Sincerely,»

»
»
Isabella Hastings,»
President,»
Hastings Information Services»
```

SuperWriter sets its formatting and merge commands off from your text with the backslash (\). Since commands do not have to be flush with the left margin, you can merge boilerplate files directly into existing paragraphs.

the manufacturer, Computer Associates. Because the manual leaves out vital details, even putting together a simple merge run can be a complex chore.

Still, there's a lot of meat here. Once you figure out how to use it, you'll find features that any programming jock would love. In addition to a merge language with IF . . . THEN statements, *SuperWriter* offers a wealth of extra processing controls.

If you want to start processing at the 50th record in your data file and stop at the 70th, *SuperWriter* has a command to do it. If you want to skip records that meet certain conditions, *SuperWriter* can do that too. It also includes a floating-dollar-sign format to make your incoming numbers look pretty and a special variable that lets you test the length in characters of each data item.

If you want to get even fancier, *SuperWriter* will let you examine some of its own internal variables. You can pull the DOS date into your documents or refer to the current page number, column number, line number, or record number in your processing. These features are useful if you want to refer to figures or illustrations in other sections of your document.

You can also prompt the operator for keyboard responses at print time—handy if you want to include a personalized phrase or paragraph for a few of the people on your mailing list. *SuperWriter* offers a powerful macro facility that lets you fully automate a merge run.

SuperWriter separates its commands from the main text by using backslashes

(\). Unlike the MicroPro *MailMerge* commands, these do not have to be flush left, so you can merge boilerplate into the middle of an existing paragraph.

Unfortunately, getting all of this power working for you can be a long and frustrating process. A program this complex needs a detailed, well-organized manual, and the *SuperWriter* manual is neither. It omits vital information.

I had problems getting *SuperWriter* to perform even the simplest merge functions because of missing information. My troubles began when I tried to use an address file created by my database program. Instead of the usual comma-delimited format, *SuperWriter* needs its own special data formats. One acceptable format, which some database packages can produce, is a tabular, spreadsheetlike format in which each data item begins in the same column on each line. You then have to do some precise bookkeeping, telling *SuperWriter* how many characters are in each record and in each data item. You'll get a very jumbled mail merge if your count is off—a mistake that is almost guaranteed since the manual doesn't tell you that your count has to include the carriage return and line-feed on each line. I figured this out on my own after a very frustrating hour.

The tabular data format also gave me trouble when I tried to print three-in-a-row mailing labels. *SuperWriter* balked, and not even the technical folks at Computer Associates could explain why.

SuperWriter's other data format, in which each data item appears on its own line, is less troublesome because you don't have to keep track of the length of your re-

cords. Using this format, I was able to print three-in-a-row labels with ease. However, this format is not as common as comma-delimited.

In sum, *SuperWriter* has a muscular mail-merger, but even experienced programmers will wince and grimace in the attempt to flex it.

WORD RESULT

Word Result is a self-contained word processing package for MS-DOS that includes a mail-merge capability. It incorporates all the basic features required by most offices, including simple math functions, as well as some unusual options such as condensed or reversed (white-on-black) text if your printer can handle it. You can arrange data wherever you like through a merge document and save records and extract subsets of records from a file.

You define a data file by setting up a data-entry form that lists up to 14 field names down the first column in vertical format:

```
Name      : Kim Morrow
Company   : Acme Tool & Dye
Address   : 4545 Unin Way
City      : Milbrae
State     : WA
ZIP       : 99999
```

A field can be up to 60 characters in length. The total number of records you can store depends on the size of each record, but the manual suggests that if your records are about 150 characters each, you will be limited to under 2,000 records in a

Despite some confusing terminology (files are referred to as "registers," for example), data entry is painless with *Handit's* Word Result, since the user creates his own field names.

■ **MAIL-MERGE**

single file—not many, by some standards.

The data file (or "register" as it is called in this system) is always automatically sorted by key field; only one key field is allowed per register. You can create additional registers that sort the same data under a different key field.

■ *Word Result*

incorporates all the basic features required by most offices as well as some unusual options.

You select subsets of records by creating "maps" to indicate selection criteria for each field. Selection criteria take one of two forms: match the entered value exactly or select records that fall within an entered range of values. Once you have created a map, you view the selected records in either the "positive" version of the map or a "negative" version that shows only those records not selected. You can store more than one map for any given register and use combinations of maps to yield the equivalent of AND/OR conditional selections.

In the text document, such as a form letter, you identify variable names by using the function keys. You cannot distinguish between variable names and normal text while in entry mode, but a function key changes the screen to display a highlighted z on either side of words identified as variable names. Unfortunately, you cannot type text in this display mode, and no error messages appear if you spell a variable name incorrectly. Instead, the misspelled variable name (not the variable data) will print out in the merged document.

Word Result is copy-protected, but you can install it on a hard disk system and then uninstall it (following procedures specified in the manual) to move it to another hard disk or program disk.

Although you can bring straight ASCII text into a text file under *Word Result*, the program cannot read data files created by

■ *Word Result* is menu-driven, although you can execute 25 commands with the function keys.

other programs, including comma-delimited files.

The package lets you select from 11 different language keyboards (U.S., French, German, Spanish, Italian, English, Swedish, Danish, Norwegian, Finnish, and Israeli). The manual itself uses some unconventional terms: the data file is called a "register," for instance, and parameters that follow a command are called "nouns"), but it is otherwise clearly written and easy to follow. One third of the 150-page manual is devoted to a tutorial that takes you through all the basic steps in 13 short lessons; the remainder of the documentation consists of a reference section organized by function.

The program is menu-driven and incorporates on-line help. You make menu selections using the cursor keys. As an alternative, you can execute the 25 primary commands using the ten function keys in combination with the Shift and Alt keys; some of these commands invoke submenus of parameters. The commands or

parameters associated with each function key are always shown along the bottom of the screen. These aids, and the fact that the word processing program itself is rather simple in the functions it offers, make *Word Result* easy to learn and use.

Dara Pearlman, Diane Burns, and S. Venit are frequent contributors to PC Magazine.

The PC's New Frontier

MUSIC

Despite their severely limited sense of sound, personal computers, when teamed up with a synthesizer and the right software, can make music—which could be good for business.

Among classical musicians, it's an old joke to say that a hapless singer has a voice like a conductor. This double-edged put-down also holds for the IBM PC's musical limitations. The PC is weak as a singer of songs, but potentially very powerful as a conductor. The newest musical software is designed to take advantage of the PC in this stronger role.

The IBM PC's musical limitations—and those of most alternative all-purpose business computers—are legendary. It can play only a single note at a time through its built-in speaker, and there's no way to control how loud it warbles and beeps. By comparison, most home computers—the PCjr included—are musical prodigies, thanks to specialized sound chips that can generate three or four simultaneous voices in harmony. Owing to this hardware advantage, most of the interesting musical software that uses the MIDI standard for electronic music (see sidebar, "The MIDI Standard") has so far been targeted not at PCs, but at the Commodore 64 and the Apple II series. Which is a shame because, as some business us-

ers have begun to discover, the most effective way to tone up presentation graphics is to create a musical background.

Now a new generation of MIDI-compatible sonic software has arrived, and the best of these programs can put an IBM PC at the center of an ensemble of state-of-the-art synthesizers. With the new programs, called sequencers, a single PC can direct a performance by 16 synthesizers, each instrument playing a different part. (See sidebar, "Software Sequencers.") Other

programs enable the PC to capture an improvised performance and display it in a notated form that a musician could revise on the PC's screen. Still other programs let the PC teach synthesizers how to produce new types of sounds and maintain a repertoire of different voices.

THE MUSICIAN'S CHOICE Musical software is making computers popular with musicians for the most compelling reason—money. Synthesizer players and composers often find that a personal computer programmed for music costs less than dedicated music hardware of the same capability. If the PC can emulate several musical devices at once or offer a greater storage capacity, the cost advantages multiply. Also, when more-powerful products come along, it is less expensive to upgrade or replace software than specialized boxes of musical hardware. For less than $1,000, you can equip a PC with music software, a MIDI interface (Casio's CZ-101, which lists at $499 and is sometimes discounted as low as $280 (Casio Inc., Electronic Musical Instrument Division, 15 Gardner Rd., Fairfield, NJ 07006; (201) 882-1493). With equipment like this run by someone with a musical background, companies that use PCs to create business-presentation graphics could easily augment and enhance their presentations with synchronized sound.

The PC also offers musicians unique advantages that can help them underbid the competition. Roger Powell, a musician in the rock band Utopia and programmer of *Texture*, says that the computer helps him work more efficiently in the recording studio. (*Texture*—from Cherry Lane Technologies, P.O. Box 430, Chester, NY 10537; (914) 937-8601—is currently being revised and was not available for this review.) Powell is often contracted to create sound and music accompaniments for commercial audiovisual presentations.

"With these machines," he says, "I can undercut everyone else in New York when bidding on these jobs." Powell says he doesn't have to spend as much time in expensive recording studios because the computer is already programmed to let multiple synthesizers perform a composition in a single take. If a client wants

changes in the music, it's easy to make them on the spot with the computer and the right software.

This review examines four programs that can turn a personal computer into a musical prodigy: Octave Plateau Electronics' *Sequencer Plus*, *Personal Composer* from Standard Productions, *MIDI Ensemble* from Sight & Sound Music Software Inc., and *Music Processing System* from Roland Music Software. Any of these will accomplish the major task of letting you compose and edit music with your PC, but each includes unique features that may suit users with special needs.

PC EDITOR'S CHOICE

For recording and coordinating instruments on a MIDI sequencer, Sequencer Plus stands out, offering a clear user interface that lets you make good selections while speedily recording and editing a composition. Personal Composer is a good choice when traditional music notation is needed. The notation can be printed out or used to drive synthesizers directly.

SEQUENCER PLUS

Sequencer Plus, Version 2.0, is a music sequencer that puts an amazing amount of information in front of you but at the same time succeeds in keeping it from overwhelming you. You can jump in a flash from one screen or window to another for different points of view on the music, and somehow never get confused. If you stop to think about where you've just been, you might break out in a cold sweat.

The relationships between the separate parts of the program are extremely well structured and integrated, so that your movements through a composition can become instinctive very quickly. A single keystroke usually zooms you down to a screen that contains a more finely detailed perspective; the Esc key takes you back up to the previous level.

THE TRACKS START HERE The main screen lists the program's 64 tracks in a scrolling window directory. That's a lot of tracks to keep track of, but you can label each with a short descriptive phrase and assign it to a MIDI channel or transpose it to another octave or interval. You can also input the number of the first programmed voice you wish the instrument receiving that track to use (*Sequencer Plus* starts its numbering with 0 so you may have to subtract 1 from the number that actually appears on the instrument).

You select the track you want to record on from a MIDI instrument by putting the cursor in its row, then hitting the R key and the Space bar. To play back what you've just recorded, you need only hit the Space bar. When playing back the music, you can opt to hear only a single track by turning on its Solo flag, or you can ignore some tracks temporarily by activating their Mute flags.

For a more detailed view of what you've recorded on all the tracks, press the V key. Some of the information that was in each track's line on the Main screen will be replaced by a line of character-size symbols, one representing each measure of the track. The symbols clearly identify which measures are untouched, which have been recorded on, and which actually contain notes or other musical data.

EDITING Moving the cursor onto one of a track's measure symbols and pressing the E key brings up an Edit screen that lets

---

FACT FILE

**Sequencer Plus,
Version 2.0**
Octave Plateau
Electronics Inc.
51 Main St.
Yonkers, NY 10701
(914) 464-0235
List Price: $495

Requires: 256K RAM, one disk drive, DOS 2.0 or later, MIDI interface (Roland MPU-401 MIDI Processing Unit or Octave Plateau's OP-4001).

In Short: Provides a MIDI recording console with an excellent user interface. Sophisticated and a pleasure to use throughout.

CIRCLE 548 ON READER SERVICE CARD

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you zoom in and examine the measure in detail. The middle window of the Edit screen looks like a section of an old player-piano roll—notes are indicated by glowing bars that resemble the slots cut into a roll's paper strip.

At any given time the screen displays a single octave's worth of notes (13 semitones). As you arrive at each boundary, *Sequencer Plus* automatically readjusts its octave range so that it displays the highest concentration of recorded notes. By using the vertical cursor keys, you can search through the entire 128-semitone range that the MIDI data format can account for.

In the Edit screen or other measure-level modes, pressing the Space bar tells *Sequencer Plus* to play the music beginning with the measure you currently occupy. While the music is sounding, the measures displayed for that track will automatically

■ Synthesizer players and composers often find that a PC programmed for music costs less than dedicated music hardware with the same capability.

advance, but you can override this to scroll to any part of the composition you want without interrupting the playback.

You can move from measure to measure using the shifted Cursor Right and Cursor Left keys. You can move quickly to the first or last bar of a song by pressing the Home or End keys. A Goto command will take you directly to a numbered measure.

The beginning, end, and duration of each note are indicated by its bar's horizontal position and length. The bar's vertical position indicates its pitch, which you can identify on a scale at the left side of the screen. You can erase notes or insert new ones, taking an existing note as a model or cutting new ones to size. You can change the rhythm and pitch of notes by seizing

THE MIDI STANDARD

Digital computers and musical instruments are able to communicate thanks to a common language: the Musical Instrument Digital Interface.

In olden times, computer music programmers were left largely to their own devices, patching together systems and software that they alone could use and understand. But several years ago, most makers of electronic music equipment agreed to use standardized data formats, protocols, and hardware on instruments that could exchange digital information. The resulting MIDI (Musical Instrument Digital Interface) standard ensures that musical equipment from different manufacturers can be linked together in an integrated system.

MIDI-compatible instruments are equipped with sockets that can link them to other MIDI devices. The standard MIDI connector is a round five-pin DIN plug. According to the MIDI standard, instruments can be linked with up to 50 feet of shielded twisted-pair cable without compromising the data and its timing. The MIDI interfaces operate at a 31.25 kilobaud rate and can send a 10-bit asynchronous byte (including start and stop bits) every 320 microseconds. Messages can be sent to the entire system or only to devices assigned to one of the 16 definable channels in the MIDI system.

The MIDI connections on a device can be of three types. MIDI IN brings a stream of MIDI data into the device. MIDI OUT sends the device's output, including whatever changes and additions the device made, to the data stream. MIDI THRU passes on the received data unchanged to the MIDI IN of another instrument. When MIDI THRU connections chain together a number of devices (optimally no more than three), each will play the portions of the common data stream that apply to its channel.

The data on a channel can be status bytes, which identify the type of data that follows, and data bytes, which indicate specific notes, their loudness, degree of

pitch bending, the type of sound to use, and other factors. Digital audio encodes the actual frequencies composing the waveforms that make up the music. MIDI data refers to pitches by number, as they would fall on a piano-like keyboard with 128 keys. The piano's 88 keys fall in the center of that scale; middle C is called MIDI note number 60.

In the time stream of MIDI data, each sound is triggered by a Note On byte when its key is pressed (or an equivalent input), and a Note Off byte when the key is released. If a touch-sensitive keyboard is used, the velocity with which the player's finger strikes a key can be carried as part of the Note On data. In between these two events, data for other controllers can shape the character of the note, making it louder or softer.

Other MIDI data can be targeted to specific types of instruments. Each manufacturer participating in the MIDI standard is assigned an identification number. If this is transmitted as part of the MIDI data, the bytes that follow are received solely by that manufacturer's machines. Thus each manufacturer can use the MIDI link to ensure proprietary features for its own products without undermining their general compatibility with other MIDI devices. The provisions that permit devices to ignore inapplicable parts of the data stream is a big part of what makes MIDI such an effective universal standard.

The International MIDI Association (IMA) is a central source of information about the MIDI standard. This group publishes a booklet describing the MIDI 1.0 specification, a monthly newsletter, and more detailed documentation for its members. The International MIDI Association is located at 11857 Hartshook St., North Hollywood, CA 91607, (818) 505-8964.—*James Langdell*

```
╔══════════════════════════ Main ══════════════════════════╗
Timesig 4/4      Tempo 100    STOP                    Mem 32000
Song sleep       Track  5 New Track        Bar 1     Beat (16th) 0

Trk Name                    Chan Prog Trans Quant Loop Mute    Number of bars
1  Sleep Bass                 1    8    0                3      30
2  Sleep Chords               1    8    0                3      30
3  Sleep Tune                 2   14                     3      30
4  CZ Changes - Voice 2       2   14                     3      30
5  New Track                  1    8    0   1: 84        6      0
6  track just recorded        1    8                     7      7
7                             2   14                     7      7
8                             1    8                     8      0
9                             1    8                     9      0
10                            1    8                    10      0
11                            1    8                    11      0
12                            1    8                    12      0
13                            1    8                    13      0
14                            1    8                    14      0
╠══════════════════════════ Main Menu ═════════════════════════╣
  Record  Delete  Mute  Loop  Name    Solo  Tempo  EDIT  FILES  OPTIONS  VIEW
  PUNCH-IN  Quit
╠══════════════════════════════════════════════════════════════╣
SPACE BAR: Start/Stop    ** select item   ↑↓ select track   F1, F2: Full Help
Press 1st letter of item to select MENU or Command.  '?' - menu command Help
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Sequencer Plus's recording screen is so well integrated with the rest of the program that you can easily move between it and the other modes.

them (individually or in a block) and placing them elsewhere on the screen; a note will retain its original nuance when moved to a new position.

Anything you delete while editing is automatically saved in a buffer file, in case you want to restore it or save it elsewhere. Thus, *Sequencer Plus's* Zap command performs the same function as the Move command in most programs. When involved in extensive copying or reorganization within a song, you can maintain up to 11 separate buffers that are filled when you execute the Copy command.

To examine the nuance of a note in more detail, put the cursor on its bar and hit the N key. This sends you to the Note screen, which displays all the controller data that might apply to that note, such as any pitch bending or changing dynamics that affect it.

The special MIDI data for a full measure can be examined and edited on the MIDI mode screen, which you reach by pressing the M key. Where MIDI events happen in time within the measure, an initial letter identifies the type of event, such as B for note bending or P for program change. When you place the cursor on the letter, the screen lists the full data it represents.

ORGANIZATION PLUS *Sequencer Plus* lets you save and load files containing individual tracks or entire songs. From within the program, you can see directories of song or track files on any disk.

The menus and data on each screen are largely self-explanatory. The program's structure is logical enough that you usually can find what you want in the first place you'd think to look. On top of this, Octave Plateau took care to provide an excellent manual and extensive help screens that appear when you press F1 or F2.

The lengthy manual covers virtually every aspect of the program twice: first in a tutorial, then afterward in a reference section. The text goes well beyond describing the workings of *Sequencer Plus*—it's filled with good advice about how to get the best use out of every component in your MIDI system.

All in all, *Sequencer Plus* is a well-crafted, professional musical instrument. Its recording modes let you work with tracks smoothly and rapidly. And the unusual player-piano format for displaying notes is clear enough so that I learned to read these screens for their musical content in remarkably little time. For most recording projects, *Sequencer Plus* would be my first-choice program.

PERSONAL COMPOSER

The most innovative part of *Personal Composer* is also the most old-fashioned: this program lets you write traditional musical notation on its screen and then hear the composition played through a synthesizer. More astonishing is its ability to record a synthesizer performance and convert it into reasonably accurate written musical notation.

Musical notation is a complicated language, but *Personal Composer* is fluent in a wide vocabulary of musical symbols. You must confront this complexity when learning the program. A knowledgeable music reader learning to notate compositions with *Personal Composer* would have to ascend approximately the same learning curve as a literate person using a typewriter for the first time.

When you start up *Personal Composer*, it displays a blank screen with a cursor in the center. Wherever you position this cursor, you can insert a musical symbol by typing a two-character command and responding to any subsequent questions.

STAFFING UP THE SCREEN You'll want to hang your notes someplace, so the first thing to add to the screen is a five-line staff. To do this, press the Home key to move the cursor to the screen's upper left-hand corner, then press the D key to drop it down slightly (you can't use higher notes, or ledger lines, if the staff is placed too

close to the top of the screen). Now type the letters ST (the staff command); after you press the first letter, the screen's bottom line will describe all commands that begin with the letter S. You then press the End key to move the cursor to the right side of the screen. Finally, when you press Enter, the computer will draw a staff across the screen.

You can draw more lined staffs to fill the screen, leaving as much space between each as you'd like. If you plan to write keyboard music, pairs of staffs can be joined

■ **The most innovative part of *Personal Composer* is also the most old-fashioned: it lets you write music in traditional notation.**

with braces, or you can link a number of staffs for an orchestral score. If you need to use more staffs than will fit on a single screen, pressing PgDn will show you the next half-screen of music. Unfortunately, the program can't scroll freely through a full page of music.

Next, the staffs need some basic musical symbols, such as clefs (use the CL command), key signatures (KE), and time signatures (TS). Once you have set up your staffs, you can start entering notes. Position the cursor where you want a notehead to appear, then type NO (the note command), reply to a prompt for the basic length of the note (Q for a quarter note, E for an eighth note, and so forth), then answer other questions about whether the stems should be drawn up or down and whether a note that's an eighth or less in duration should be barred together with similar notes. An individual note can be deleted by placing the cursor directly on its notehead and typing NO again. This toggling method can be used to eliminate most musical symbols from the screen. However, the results can be unpredictable

SOFTWARE SEQUENCERS
Current music software goes beyond just emulating a sequencer—it can turn a PC into a recording studio, complete with master mixing console.

A sequencer is a device that can record and store a series of notes, then feed them into an instrument at the proper tempo. A sequencer can store several note patterns and output them simultaneously or sequentially, repeating one note pattern a given number of times before playing the next pattern.

With software that now exists, a PC can act like a basic sequencer for a MIDI system and do much more. It can expand on the sequencer concept by storing other performance data along with the raw notes: dynamic levels, pitch bending, aftertouch, and signals from any sort of continuous controller a synthesizer might use. Since the PC has a larger memory capacity than any dedicated sequencer, it can use music software that stores more note patterns—and longer ones—in more-elaborate relationships.

But a PC can do more than just sequencing. The PC's keyboard and screen offer a more flexible system for displaying and manipulating music than is available on most music devices. When dealing with MIDI data, a PC can be used like the tape recorders and master mixing console in a recording studio.

All four of the programs reviewed here can record musical input onto multiple tracks within the computer's memory (from 8 to 64, depending on the program) and play the music back through any of the 16 MIDI channels simultaneously. Each lets you edit tracks in a way modeled on the tape-recording technique of "punch in/punch out." When using this feature, you record new material onto a track between two specified time points, leaving the rest unchanged.

Another musical job that software can do is maintain libraries of voice-changing routines for synthesizers. Many synthesizers allow a musician to program original sounds beyond those that are preprogrammed. The adjustments that

produce a unique voice are referred to as patches, or programs. You can transmit these patches as MIDI data and use a PC to store the patches for loading into the instrument later.

Each manufacturer's synthesizers use a different means of programming new voices, so a computer program must be tailored to create patches for particular instruments. *Personal Composer* is able to serve as the voice librarian for Yamaha's DX7 family of synthesizers. This feature of *Personal Composer* is not reviewed here; rather, only its sequencer aspects are described. *Personal Composer*'s librarian feature will be considered in detail when *PC Magazine* reviews other programs that can change a synthesizer's voices.

All of these programs are able to call for a synthesizer's different preprogrammed voices by referring to them by number, even in the middle of a composition. Sometimes a computer can tell the instrument to do more-complex voicings than could be played directly on its keyboard. The Casio CZ-101 is able to produce only one type of sound at a time when you play on its keyboard, but the computer can send it instructions on four MIDI channels that make it sound like a pipe organ, a vibraphone, a trumpet, and a violin simultaneously.

Each of these programs lets you examine musical data for detailed editing. The four programs differ the most in this area, as each is modeled on a different metaphor from the musical world. *Sequencer Plus* formats its musical data in a way that resembles the piano roll used on player pianos, as does *MIDI Ensemble*. *Personal Composer* uses traditional musical notation like that found on a conductor's score; Roland's *MPS* is similar to it. *Texture*, which we were unable to review, is organized like a recording studio's tape-editing system.—James Langdell

Meet our P

Choosing a modem for your personal computer just got easier.

Modems are remarkable little gadgets. They can connect you and your PC to mountains of data and oceans of information. But up until now, deciding which modem to buy hasn't been easy. So to solve that little problem, IBM is offering two 1,200 bps PC modems. Modems that not only give you the best features currently available on PC modems, but also offer features usually found only on higher priced, higher speed modems.

First, a Brief Introduction to the IBM PC Modems:

The IBM 5841 is a stand-alone modem capable of operating at 0-300, 600 and 1,200 bps in asynchronous mode, and 600 and 1,200 bps synchronous.

Our other modem is the IBM Personal Computer Modem—an internal, half-card modem that operates at 0-300, 600 and 1,200 bps asynchronous.

The Non-Identical Twins

In some respects, these two modems are very similar. For example, they both have Automatic Adaptive Equalization—which means they will continuously fine-tune themselves to compensate for changes and noises on the telephone line. The result is, you can receive data over a wider range of phone line conditions. This is one of those features more often found on faster, more expensive modems.

In addition to automatic answering, both modems offer Adaptive Dialing—which means that if you don't specify either tone or pulse dialing, the modems try tone dialing for one digit, and if that doesn't work,

they automatically switch to pulse dialing.

Both modems will automatically re-dial a number as many times as you tell them to. Or if you prefer, they can switch to an alternate number on a busy signal or a no answer. Once a connection is made, the modems automatically detect and adjust to the incoming transmission speed. They can also initiate an automatic log-on sequence including control characters, ID number and password.

And both modems have extensive "Help" menus, a complete complement of built-in diagnostics, a programmable speaker, and two phone jacks on the back so both your phone and the modem can be connected to the same line at the same time. You can even switch between voice and data without interrupting the phone call.

A Modem with a Memory of Its Own

The IBM 5841 stand-alone modem has some additional features you don't usually find on 1,200 bps modems. For example, the modem is switchable between asynchronous and synchronous modes and has a 20-entry Dialing Directory. Kept in non-volatile

CHAN NAMES	NAME	XPS	VOL	PED	TRK	CLF	DIS	SPL
1	Flute	-3	0	0	1	t	65	0
2	Fagotti	-12	0	0	1	b	45	0
3	Harpsichord	33	0	0	1	p	65	54
4	Synthesizer	-3	7	64	1	t	45	66
5	Light Board		0	0	1	t	45	0
6	Drum Machin		0	0	1	t	65	0
7		0	0	0	1	p	95	0
8		0	0	0	1	p	95	0
9		0	0	0	1	p	95	0
10		0	0	0	1	p	95	0
11		0	0	0	1	p	95	0
12		0	0	0	1	p	95	0
13		0	0	0	1	p	95	0
14		0	0	0	1	p	95	0
15		0	0	0	1	p	95	0
16		0	0	0	1	p	95	0

Synthony   clf: type: t-treble, b-bass (default-piano :?

MEASURE=s	0M
PROGRAM'S	0M
NAME's	0M
EXIT	

Personal Composer's note-editing screen lets you create a musical score that you can either print out or play through synthesizers.

because the cursor must be in the same location as it was when the symbol was first created. With larger symbols (like clefs), it isn't always clear where that point originally was.

You add sharps, flats, rests, ties, bar lines, and fermatas in a similar way. *Personal Composer* also has a text mode, so that you can place verbal instructions and song lyrics in a score.

You can hear whatever music you've notated on the screen through a synthesizer when you type PL, the play command. In the musical score, you can include the MIDI channel each line should be sent to, as well as the preprogrammed voice (identified by number) the instrument should use when performing those notes.

When you want a printed copy of your composition, a dot matrix graphics printer will start grinding out the lines and spaces at the touch of the PR command. At this point, you'll discover that *Personal Composer* is really a "what you see is what you get" program, since the Hercules monochrome graphics board displays the score with the same level of detail that it will have when printed. To improve the printed result, you can proofread the notation with a command that automatically checks for rhythmic errors—a measure of a waltz,

say, into which you tried to cram in 4½ beats' worth of notes.

Another command can transpose a staff of music into another key. The program notates transpositions using sharp and natural signs exclusively—even in keys where the equivalent flatted notes should be used. Thus the transposed version will sound correct, but you'll have to edit out many accidental signs before you print a finished copy.

MUSICAL MACROS You've probably gotten the impression that you need a lot of keystrokes to put music on the *Personal Composer* screen. Unfortunately, you're right. But you can spare yourself some of this effort if you use *Personal Composer's* copy commands when a composition repeats measures or groups of notes. More general relief is available, however, from the program's keystroke-macro feature. *Personal Composer* can store sequences of up to 2,000 keystrokes as you type them in the first time. You can then assign your macro to any two-character combination that isn't already being used as a command.

You can create another type of customized two-character commands in *Personal Composer's* MIDIgraphics mode. Here,

you can plot out new musical symbols on a pixel grid, to be inserted into your manuscripts when you type the two-character names you assign to them. Lines or blocks of text, such as a repeated phrase in a song lyric, can also be saved as MIDIgraphics. Despite the somewhat misleading name, MIDIgraphics cannot influence the way the music is played by MIDI-compatible instruments; it can only contribute to the appearance of the printed manuscript.

You could potentially save frequently used macros and MIDIgraphics in files to be loaded into the computer before each composing session. Unfortunately *Personal Composer* can't call up a directory of files on a disk. The manual mentions a command that allows you to execute DOS-level commands, but it's not yet implemented in this version of *Personal Composer*.

CAPTURING THE KEYS Converting a musician's performance into notation is a far trickier task than turning notation into sound. When I tell musician friends that a computer is able to create a score, many drop their jaws in astonishment—especially when they hear that you can edit this computer-notated score and play the revised version. The recording mode of *Personal Composer* does indeed perform this miracle. The results, however, are somewhat mixed.

In recording mode, you can save a "take" of a live performance on one of the 32 tracks that *Personal Composer* can hold in the computer's memory. After you've dubbed one or more tracks, you convert them into notation by indicating the key and time signatures and selecting Graphics from the recording mode's menu. In a minute or so, you'll see—lo and behold—an edit-mode screen filled with freshly generated staffs and notes.

Within this computer-generated score, however, some strange errors sometimes show up. Notes from different tracks might seem to have been cast onto staffs in random order. A reckless stack of ledger lines might be used in an attempt to fit a melody onto a bass clef staff. Separate notes of a melody might be clumped together. The tones in a block chord might be fragmented, with flag-heavy rest signs scattered among the notes. This isn't the

way you imagined the music would look when you played it!

The problem is that music performed by a human contains many more nuances than can be noted on paper. Timings and lengths of notes vary subtly from one performance to the next. It's asking a lot of a computer to record a performance precisely—yet only in as much detail as a score normally includes. If the finer details aren't filtered out, the resulting notation is more likely to confuse than guide a performer.

Personal Composer's notation comes closer to the mark if you use the settings

■ **Converting a musician's performance into notation is far trickier than turning notation into sound.**

that most closely round off note lengths to a specified minimum value—usually a 16th note—before converting recorded tracks into notation. It also helps to make proper settings on the channels screen, assigning MIDI channels to the desired staffs. But since you need to anticipate so many variables, predictable results come only after much experimentation.

RECORDING If you are using *Personal Composer* only to record music and deal with them in non-notated form, you'll find the user interface more cumbersome and less informative than those of most other sequencer programs. The recording mode screen doesn't give much detail about each track. It doesn't even indicate the channel assignment or other default values for all already-recorded tracks unless you made a point of writing that value into the track data columns at the top of the screen.

Unlike the one-character keyboard commands used by the editing mode, *Personal Composer*'s recording mode requires you to move the cursor onto a command or data item before you deal with it.

MIDI COMPATIBLES

Working with MIDI compatibles lets musicians and composers concentrate on artistic effects without worrying about technical details.

A well-implemented MIDI-compatible product should shield users from most of the technical details of MIDI interfacing, clearing the way for them to work in terms of the 16 MIDI channels that link musical input and output devices. These channels are just like the channels on a tape recorder or a sound mixing board.

There are myriad devices that the computer can deal with through a MIDI interface for live performance or in a recording studio. Most current models of keyboard synthesizers—made by Casio, Kurzweil, Oberheim, Roland, Yamaha, and others—are MIDI compatible. Newer, more compact and economical synthesizers like the Yamaha TX-7 are being designed without keyboards because they can now be controlled by other devices in a MIDI system. There's also a whole range of specialized synthesizers such as drum machines, bass boxes, and sound samplers. MIDI input devices include keyboards, drum pads, breath controllers, foot pedals, and various styles of "MIDI guitars." In a recording studio, filters, delays, and other effects can be controlled and adjusted automatically in the MIDI operation.

Even acoustic instruments can be part of a MIDI system. A system called the Pitchrider (available from Cherry Lane Technologies) converts the playing of a single-line instrument, such as a saxophone, into MIDI information. One company advertises that accordions can

This arrangement is convenient only if you use a mouse. Another problem is that you can't select specific tracks to listen to without changing channel assignments. Most other sequencers let you mute tracks temporarily without changing the configuration.

Personal Composer shines at the simple task of allowing you to write and edit

be converted into MIDI input devices.

MIDI instrumentation can also be used to coordinate musical devices with a video or film editing system. This ability facilitates synchronization when you are recording a soundtrack and gives you greater control over the timing of music while you are composing and after. Even stage lighting systems have been controlled through MIDI channels.

MEETING MIDI HALFWAY Most computers don't have a built-in MIDI interface (the Atari 520ST is an exception), but one can be added to a slot inside the IBM PC. The most widely used interface is made by Roland: an MIF-IPC card that can fit in a short slot and be cabled to an external Roland MPU-401 connector box. Other MIDI interfaces for the IBM PC are available (including one from Octave Plateau), but Roland's hardware is a de facto standard. All the software reviewed here can be used with the Roland interface hardware.

The Roland MPU-401 is a box the size of a paperback book with sockets for one MIDI IN (to send information to the computer), two MIDI OUTs (so the computer can control two instruments directly), and one MIDI THRU. The MPU-401 has a built-in metronome; the unit itself produces an audible tick that can guide your playing. The interface also can be controlled by timing signals from an external synchronizing device.—*James Langdell*

music on-screen before printing it out or playing it through a synthesizer. Considered solely as a program for storing and manipulating tracks recorded from MIDI instruments, *Personal Composer* is only OK, and the program's inconsistent integration between recording and notating modes can turn a more ambitious recording and editing project into a nightmare. It

seems that interacting with MIDI instruments with ease and mutually handling traditional music notation are mutually exclusive talents—at least until more mature software turns computer-generated musical notation into an everyday miracle.

MIDI ENSEMBLE

MIDI Ensemble, like *Sequencer Plus*, presents its finest musical details in a piano-roll format. Most of the differences between the two programs involve finer points concerning the user interface. A musician choosing between these two programs has a plight similar to that of a pianist choosing between a Baldwin and a Steinway grand piano.

Sight & Sound adopted an unusual form of software protection for its product. You can make as many copies of the program disk as you want, but the software can run only on a system in which you've attached Sight & Sound's hardware "key" to the cable between the computer and the Roland MPU-401. This 2-inch-long, 25-pin connector contains codes that must match those embedded in your copy of the software. I found that the key could remain attached without interfering with other music software that uses the MPU-401.

Before you can run the *MIDI Ensemble* program, you must first configure it. A setup program asks you questions about your hardware configuration, display options such as screen color, and musical default values. This configuration procedure is easier to use than most because you can move freely through the options. A few of the options that you can set only at this stage, such as chord parameters, might be more conveniently adjustable from within the program.

SIX-OPTION MENU *MIDI Ensemble* starts up with a six-item menu. Here you'll find options for Recording, the Event Editor, the Phrase Editor, a Directory, a Text Page, or to Return to DOS. You choose from these items by moving the highlighted cursor and pressing Return, or by just typing your selection's initial letter. This menu gives you the first evidence of *MIDI Ensemble*'s handy command structure, which usually offers several ways to do any task.

In the Recording mode, you have up to 256 tracks of music at your disposal, of which 8 can be played back at a time. The main benefit of this huge track capacity is

the freedom it gives you to hold onto a lot of different takes and fragments while editing a composition.

You can divide the Recording mode's screen into windows, allowing you to monitor many musical factors at a glance. In the console window, basic information for 16 tracks can appear at one time. The cursor and function keys move you fluently among these tracks so that you can specify which you want to record on, play back, or mute. If you ask to record on a track that already contains music, the program automatically assumes you want to "punch in," or record, over only part of the track and gives you appropriate prompts. There's no looping capability, however.

The console window also lets you make immediate changes in each track's channel assignment and pitch transposition. You can't, however, indicate voice program changes for each channel, as you can with *Sequencer Plus*'s basic track table.

MIDI Ensemble lets you indicate lengths of tracks and punch-ins either in standard measure and beat units or in clock time and frames—more suitable when synchronizing soundtracks for film and videotape. You can specify three tempos that can be called up at a keystroke during recording or playback of music. During playback, function keys let you mark the beginning and end of a phrase to be dealt with later in the Phrase Editor.

In its Event Editor, *MIDI Ensemble* displays notes in piano-roll format. As in *Sequencer Plus*, each screen displays one measure's worth of notes from a single track. *MIDI Ensemble*, however, represents pitches with thinner lines—which enables it to display an 88-pitch range on a single screen. This greater detail is made possible by the color/graphics adapter, which this mode alone requires. (*Sequencer Plus* uses coarser, monochrome-compatible character graphics.)

As you move the cursor within a measure, it hops in rhythmic order from note to note (or chord to chord), sounding each pitch it lands on. You can ask the Event Editor to show you the cursor-touched notes in two other ways: with noteheads on a musical staff or as dots on a piano keyboard displayed at the bottom of the screen. These two visual aids can be dis-

The recording screen of Midi Ensemble lets you record up to 256 tracks in any given song. Only 8 tracks, however, can be played back at a time.

played concurrently, but they cover over the function key command menu and much of the status information that would otherwise be visible.

EDITING OPTIONS Once you memorize a few editing commands, which are described on a separate screen, you should find it easy to manipulate individual notes. You can insert new pitches of a preset length; the currently available rhythmic unit is set by cycling through the choices displayed in that item on the status line. The displayed measure is then sliced into this note length by a superimposed grid.

You can delete an existing note or change its pitch, timing, and length. First you move the cursor onto the note and grab it by pressing the Enter key. You then use the cursor keys in different modes to move it to another pitch or position. You can change the note's length to a standard rhythmic unit or expand and trim it by MIDI counts—the smallest time measurement in the MIDI language. The Event Editor, however, doesn't seem to have an easy way to seize a note and replicate it (say, to fill out a chord) without disturbing the original note.

The Event Editor also allows you to view and change certain other types of MIDI data besides the notes themselves. You can deal with program changes, which tell a synthesizer to switch to another voice, or you can change the channel assignment in the middle of a track. If the music was originally input with a touch-sensitive keyboard, you can see the velocity data for each note and can change this value to affect the note's loudness. Although *MIDI Ensemble* is able to record just about any type of MIDI data on its tracks, it doesn't offer you a way to do detailed editing of input from such devices as pitch-bend wheels and sustain pedals.

In the Event Editor, you can insert phrase markers in a track or move markers that were already placed in the Recording mode. Such phrases can be called on and manipulated later in the Phrase Editor.

> ■ *MIDI Ensemble* lets you indicate lengths of tracks either in standard measure and beat units or in clock time and time frames.

TURNING A PHRASE In that mode, you'll see a list of available phrases at the top of the screen. Below that is a line chart showing each phrase's position in the song. In this editing mode, you can slice other phrases from tracks and delete, duplicate, reposition, or merge them.

This is the most confusing part of *MIDI Ensemble*: the screen layout doesn't seem to give you a clear perspective on relationships between portions of the music and the whole song. Cherry Lane's *Texture*, for example, has a much clearer arrangement for dealing with phrases in isolation.

Within the Phrase Editor, you can use an Autocorrect function to even up the rhythm in a phrase. It repositions each note either to fixed subdivisions of the metronomic beat. By making such changes at the phrase level, you can leave other musical passages on a track in a freer rhythm if you wish.

One thoughtful feature put into *MIDI Ensemble* is its Text Page, a single screen for associating freeform text and graphic symbols with each song. On this page, you can write working notes, lyrics, and instructions on how to set up MIDI instruments for playing the composition, or attach a copyright notice to the music.

MIDI Ensemble's manual is organized around clear explanations of each command and individual option that appears in the course of the program. However, the manual does not have a tutorial that might make clearer how these commands can be used in context to produce specific musical results. On that ground, I was more impressed by the manual for *Sequencer Plus*.

MIDI Ensemble might be the product of choice for some categories of special users; for example, it lets you select time units that are more appropriate for video and film recording. In general, though, I've been too spoiled by *Sequencer Plus* to appreciate just how good *MIDI Ensemble* is. The two offer similar features at an identical price, and both make very effective use of player-piano notation (even a sheet-music maven like me is beginning to consider that format the most suitable way to display music on a PC). If you're in the market for a sequencer with a huge storage capacity, both these programs are worth a look.

MUSIC PROCESSING SYSTEM

Roland's program, *Music Processing System*, like *Personal Composer*, displays and prints recorded music in traditional notation. The trouble is, it doesn't do this very well.
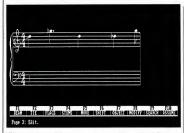
MPS is divided into three main modes: song, score, and print. In song mode, you can record and play back eight tracks and manipulate groups of measures. In score mode, you can convert recorded phrases into staff notation or input notes directly onto the screen. Print mode, as you might assume, is where you organize individual measures into a page of music, which can then be printed out in this higher-resolution format.

One given limitation is that *MPS* is designed to use IBM's standard high-resolution mode, so this program has far less detail available than *Personal Composer*. That program insists on a Hercules monochrome graphics board, 4for what prove to

MPS's score mode screen displays one measure of music recorded on a single track. The horizontal placement of notes determines their rhythm.

be good reasons. It's able to display about half a printed page of music on a monochrome screen, while MPS can handle only a single two-staff measure at a time.

MPS allows you to work with only eight tracks at a time. Additional tracks could be stored in separate disk files or merged to clear some space. But this is the lowest track ceiling found in any of these programs. Perhaps Roland restricted its software to match the limit of eight tracks that its own MIDI hardware can transmit at a time?

Another problem that constrains MPS is its cumbersome and inconsistent command structure. Nearly all commands are entered through the function keys, whose purposes change from one mode—or even one keystroke—to the next. The program offers little potential for learning to operate it faster as you gain experience.

Some function key operations must be followed by pressing Enter; after others you must hit the Space bar; still others are attached to submenus that you exit by hitting Esc. In the song mode, you play back the tracks by pressing the PgUp or PgDn keys until you reach the right command menu, then press F2 followed by the Space bar. In score mode, however, you hit F1 twice to start playback.

SONG MODE Song mode is where most of the real work is done in MPS. The eight tracks are displayed as horizontal bars, 80 characters wide, that represent that quantity of measures. If you want to see the rest of a longer composition, you must use a command to specify a different starting measure for the display: the program is unable to scroll smoothly through an entire song.

To record part of a track, you must first move the cursor onto the track line and measure space where you want the recording to start. Then press F1 to prime the system, followed by the Space bar to begin and end the recording. Using another group of commands, you can specify a range of measures by their numbers.

Once you have recorded a bit of music, you have to remember to save it in memory by pressing the Ins key—an important task that the Music Processing System never prompts you to do while recording. When an excerpt is saved, the measures it comprises are displayed as filled-in blocks on the screen.

In song mode, you can manipulate existing tracks by marking and "picking up" one phrase at a time, then copying it onto another track or starting measure. You could, for example, produce a round by re-

cording the melody on one track, picking it up as a phrase, and inserting it at properly staggered starting measures on other tracks. These phrase-level functions work fairly well, but the process is hampered somewhat because the screen includes no scale for identifying measure numbers and because the cursor disappears while it moves through a solid line of recorded measures.

SCORE MODE A phrase can also be carried over from song mode into score mode. A notated score can be made only from a portion of recorded music that has been defined as a phrase (not a multitrack song). Before formatting the phrase into a screen of "raw" notation, you must first use commands to specify three basic elements: meter, key signature, and minimum note value.

The last factor has a strong influence on the way the notation turns out. Although MPS produces notes that resemble the ones that musicians read, it doesn't deal with them the same way. A musician can look at a sequence of notes and rests in a bar and determine its rhythm based on the relationship between note values. MPS, however, can tell the starting time of a note only by its position in a bar. If a 16th note is specified as the minimum note value for a bar in 4/4 time, there are 16 positions across the screen where notes can be placed. Rest marks mean nothing to MPS

FLOWCHARTS
And Organization Charts

in terms of rhythm; they can only be used cosmetically when writing a score. Some acts of score editing can change the way a recorded track sounds; other changes only contribute to making a printed page of music look tidier in print mode.

PRINT MODE In print mode, you can deal only with score files that were saved in a high-resolution format. As is typical of *MPS*, when moving from score mode to print mode you aren't prompted to save your latest score in that format. If you haven't done so on your own initiative,

■ Roland's *Music Processing System* allows you to work with only eight tracks at a time.

sorry—your score is gone.

When you reach print mode with the right files, you must assemble each page to be printed, inserting one measure at a time. A page can contain four two-staff piano scores with six measures per line, at most. (This means, for instance, that in 4/4 time with 16th-note resolution, only two measures would fit on each line.)

When a single page is ready to print, it's held in a high-resolution file larger than 80,000 bytes. On an Epson LX-90 printer, it took 6 minutes to print each draft-quality page.

Compared to *MPS*, *Personal Composer* software, despite its own shortcomings, is far more facile at bridging the gap between modern synthesizers and traditional music notation. If you want to produce human-readable scores, it's a far better choice than *MPS*, even if you must invest in a Hercules board. And any of the other programs give you better tools for less challenging MIDI recording, sequencing, and phrase-editing tasks. Roland's software, sadly, doesn't live up to its musical hardware.

James Langdell is a contributing editor of PC Magazine.

Finally! An on-screen flowchart processor that knows about flowcharts and organization charts - not just another "screen draw" program that makes you do most of the work.

Interactive EasyFlow is a powerful full-screen graphics program dedicated to flowcharts and organization charts. With this program you can quickly compose charts on the screen. More importantly, you can easily modify charts so they are always up to date.

Features: ● Text is automatically centered, character by character, within shapes as you type it ● Text formatting controls allow you to over-ride the automatic formating where desired ● Lines are created by specifying the starting and ending points - the program automatically generates the route ● Powerful editing facilities allow shapes and even entire rows and columns of shapes to be inserted or deleted; lines are automatically re-routed as necessary ● Large chart size (up to 16 shapes wide by 16 shapes high) allows very large flowcharts and organization charts to be handled with ease ● Charts can be larger than the screen - the window into the chart scrolls both horizontally and vertically as necessary ● Flexible printer interface allows it to work with all printers, not just dot matrix printers. Wide charts can be printed in strips Also works with Hewlett-Packard 7475A (and compatible) plotters ● Twenty standard flowcharting shapes included ● Common shapes supplied in three sizes ● Extensive manual (125 pages) includes many examples ● Context sensitive "help" facility provides immediate assistance at any time ● Any number of titles can be placed on a chart ● Commentary text blocks can be placed anywhere in the chart ● Fast: written in 8088 assembler ● Plus many more features than we can mention here.

Requires at least 256K memory, DOS-2 or higher and an IBM or Hercules compatible graphics card.

Order direct for only $149.95 + $2.00 S&H (USA/Canada), $10.00 (foreign). Payment by MO, check, VISA, COD or Company PO. Rush orders accepted ($15.00 S&H; USA/Canada only). Rush orders received by noon will be delivered the next business day (to most locations).

The sample screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering titles, changing options, getting 'help' and so on.

STATUS BAR (not to be confused with a beer belt) tells you what Interactive EasyFlow is doing at all times

CHART WINDOW gives an overview of your chart; this example shows the "normal" view. "Close-up" view shows a smaller part of the chart in more detail. "Wide-angle" view shows a larger part of the chart at reduced size.

TEXT/MESSAGE WINDOW used to enter user text and to display messages from Interactive EasyFlow

CURRENT SHAPE WINDOW shows the content of the current flowchart shape (the one under the SHAPE CURSOR) in complete detail

SHAPE CURSOR shows where you are in the chart. Cursor keys move it around; chart window scrolls if you run off the edge of the window

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THE REPAIRS GAME

Playing the PC repairs game may never be fun, but today the odds are more with you than against you—if you know the rules and play strategically.

Pack your system unit. Go to the post office. Mail the unit to the manufacturer. Do not pass GO until you rent another unit.

Make a phone call. Open the door and greet the repairman. Exchange a monitor. Pass GO. You're back in business.

Drive to your dealer. Drop off the printer. Do not pass GO. Wait 3 days. Pay $200.

Fortunately, these moves are just a few of the choices you can make in the biggest game in town—PC repairs. More moves and more players than ever before are involved in more versions of the game. The stakes are still high, but no one has a monopoly on the right choices, and there's no one way to win.

Repair vendors are bankrolling profits like the owner of Boardwalk and Park Place, and repair services have been proliferating faster than imitations of Trivial Pursuit and spin-offs of Scrabble. When it comes to repairing your business's faulty hardware, more puzzling choices than those in Dungeons and Dragons confront you. But finding your way out of the maze is no fantasy—if you know the rules and have a winning strategy at hand.

A few years ago if you had a mix of equipment—an IBM PC, an NEC printer, a Hayes modem, and other manufacturers' peripherals at home and Wang word processors, IBM PCs, and DEC minis in the office—you were strand-

ed when trying to find someone to fix you up when things broke down. No one was ready to play the game: Fast, reliable repairs without a service contract were just a phantom of your imagination.

KEY PLAYERS Today's repair market, however, includes an impressive but puzzling array of maintenance and service vendors equipped to repair a mixed bag of hardware: manufacturers like IBM, dealer/distributors like ComputerLand, third-party maintenance vendors like Sorbus (TPMs for short; they're third in line to offer you service, after the manufacturer and the dealer), franchises like Computer Doctor, and a growing number of local independent repairers. In addition, some corporations whose business depends on computers, like Travelers Corp., have in-house maintenance and repair centers.

With all these service vendors now in the

game, the scenario in which no one is equipped to come to your rescue is now as outdated as Old Maid. With a service contract from a vendor, which is essentially a casualty and life insurance policy on your equipment, you have the choice of (in descending order of cost) on-site service with a number of available response times, pick-up service, carry-in service, overnight parts exchange, and mail-in service. Without a contract you pay for what is called Time and Materials (T&M) service. And more and more companies—national and local—are getting into the maintenance and repair business. Some repair vendors offer service on a contract basis only, a few handle T&M repairs only, but more and more do both contract and T&M business.

Yet the specter of broken equipment, halted operations, and frightening repair bills still keeps most users frozen on square one of the repairs game, afraid of what they may encounter ahead. Should you buy a service contract? If so, what type do you need and which company should you buy it from? If not, which service vendor should you call when you're in trouble? Choices like these terrify the most-experienced PC users. And that's even before the real torture—paying the bill.

THE BOOM "Service is the bread and butter of the computer industry," says Ron Shugan, director of International Data Corp.'s (IDC) Customer Service Research Program in Framingham, Massachusetts. Estimating the current market to be about $950 million a year, industry observers expect it to soar to about $2.6 billion a year by the end of the 1980s, according to International Resource Development (IRD) Inc., a market research firm in Norwalk, Connecticut.

IRD president Kenneth Bosomworth notes, however, that estimates of potential growth were about twice that high as recently as late 1984. Bosomworth scaled down his expectations of growth not only because shipments of personal computers in the last year have been much lower than expected, but, more importantly, because manufacturers are now trying more than ever before to make machines that aren't going to break. New PC's will require less and less time in the repair shop; when

something goes wrong, users will be able to unplug, throw away, and replace chunks and modules of the equipment.

That's good news, but for now you still have the problem of how to get your present equipment up and running again. "The problem is especially serious for business users," Ron Shugan emphasizes. The issues that concern most users are time, convenience, and cost. For businesses, time is usually the critical factor: How long will it take to get back in business? When can you deliver your computer-based service or perform the essential computerized work that makes your business run? Will it take hours or days? Will you lose accounts because of delays? If

> ■ The specter of broken equipment, halted operations, and frightening repair bills keeps most users frozen on square one of the repairs game.

time is the most important consideration, service contracts that guarantee fast, on-site solutions—either from the manufacturer or from a national TPM—are probably in order. The questions for you then are which company should you buy the contract from and which kind of contract should you buy.

On the other hand, think again. What about cost? Service contracts can buy you sleep at night, but they'll tax your budget severely. You may have to work so hard and long to pay for one that you won't have time to rest your weary head. They average about $2,000 a year for a basic personal computer setup, more for more complex and varied equipment. In fact, Alfred Poor, president of the Connecticut-based Soft Industries, advises against service contracts for all but the most deadline-driven businesses.

Convenience is another issue to consider when planning for service needs. With on-site service you circumvent the need to spend time and energy finding out where to take the broken equipment and then getting it there—not the most pleasant way to spend the day. So you may want to put out the money for a contract because you value convenience over cost. One repairs consultant says convenience really boils down to time: "If you're the only person available to take broken equipment in to the repair shop, and if your time is worth more per hour than the prorated cost of a contract, it pays to buy on-site service. A lawyer, say, whose billable rate is $100 an hour would be crazy to spend his time standing in the repair line."

SERVICE FROM THE SOURCE Whether you decide to contract for service or take your chances and go for T&M service, you still must decide where you want to take your repair business. First in line are manufacturers, like IBM and Tandy (through Radio Shack outlets), which earn about half of the total microcomputer repair dollars. According to many analysts, the manufacturer is the best place to get reliable service, since its people know and care about the equipment and are more likely to have quicker access to parts. If your hardware is primarily from one maker, the manufacturer may be the best choice. If you've got an IBM system, you'll probably want IBM replacement parts. Keep in mind, though, that manufacturers' rates for service contracts are usually high.

Despite competition from more and more hungry TPMs, manufacturers are still winning service contracts from big business. Companies that own thousands of word processing workstations, automated teller machines, and terminals for back-office operations—like Citicorp, Chase Manhattan, and American Express Corp.—are sticking for the most part with service from the manufacturers of their equipment. Chase, for example, has 150 data centers around the world and 200 word processing centers with a mix of IBM, Wang, and DEC equipment. The bank is sticking with manufacturers' service because, according to the vice president of telecommunications strategies,

PC MAGAZINE FACT FILE

John P. Macri, its units are so decentral-
ized and it can get better results from the
manufacturers.

Time, not cost, is the most important
consideration for this type of business,
which moves money, sells securities, and
negotiates deals around the clock. Shear-
son/Lehman Brothers' investment banking
division, for example, recently signed a
contract with Wang to maintain and ser-
vice its $7 to $8 million plus worth of new
Wang equipment, with special provisions
for after-hours and weekend on-site ser-
vice.

Manufacturers previously refused to
service mixed equipment from other ven-
dors. Now, attracted by the additional rev-
enue the repair business brings in and
alarmed by the new competition for that
revenue, most service contracts of the ma-
jor ones will cover various vendors' hard-
ware if it's attached to the manufacturer's
unit. Be sure to check whether your peri-
pherals are covered before you sign,
though.

Most manufacturers naturally prefer
that you buy a service contract from them
if your warranty is up (usually 90 days for
parts and labor), not only because that
means more revenue but also because of
the added trouble and time involved if you
have to return the machine to the factory. If
you don't contract for on-site service, they
generally advise you to bring the computer
in to one of their local authorized service
centers. Unless you live in a remote area
and don't have a service center in reason-
able proximity, shipping a bulky piece of
hardware (especially without the factory
cartons) can be more risky and trouble-
some than it's worth.

IBM offers a renewable 12 months of
service under its annual maintenance
agreement, with a range of options (avail-
ability depends on type of equipment):
IBM On-Site Service, Customer On-Site
Service, or Customer Carry-In Service.
When you buy IBM On-Site Service, an
IBM service rep comes to you and either
gives you an exchange printer or display,

which connects after disconnecting the
failing unit, or repairs your system or ex-
pansion unit. With Customer On-Site Ser-
vice, which covers only printers and dis-
plays, IBM arranges to have a printer or
display delivered to you in exchange for
the failing unit, which you disconnect; you
then connect the replacement yourself.
Customer Carry-In Service means that you
take your failing printer or display to the
nearest IBM Service/Exchange Center
during normal business hours and ex-
change it or, in the case of your system or
expansion unit, take it in for repair; you
can also send the unit in by mail or messen-
ger and receive the replacement or the re-
paired unit by the same means. You can
mix and match plans to tailor your cover-
age to your individual units. Prices range
from $24 per year for Customer Carry-In
Service for an expansion card to $653 per
year for IBM On-Site Service for an XT
system unit.

Upping its ante in the repair market,
IBM announced last August that it is offer-

ing volume discounts of 15 to 25 percent for service on selected PC models and related products. At the same time, it expanded its service coverage from 9 to 31 non-IBM products used with IBM PC, including monitors, printers, modems, and feature cards.

SERVICE FROM YOUR DEALER

Next in line for your service business is the dealer. If you have a mix of equipment you want repaired by one vendor, the dealer who sold the equipment to you (or a TPM) may be a better choice since some manufacturers still repair only their own or a limited range of other vendors' hardware. The dealer has a good chance of knowing the equipment you've got and how to repair it, but the wait for the necessary parts could take longer than with the manufacturer. Smaller businesses that choose T&M service may value the added convenience of having someone on staff take the defective hardware in to the local dealer rather than mail it off to a more distant manufacturer or TPM.

Most dealers offer a range of service options, including contracts and T&M. Although dealers attract mostly small businesses and home users for service, some large companies are buying service from dealers also. In a surprising move, United Technologies Corp. (UTC) of Connecticut bought $4 million worth of IBM equipment last year—not from IBM but from ComputerLand of Connecticut. The reason the dealer won the sale was service, according to John H. Bennet, corporate data processing director for UTC. Alarmed at the loss of business, IBM has begun to offer service for other vendors' equipment when attached to the PC and to market its service contracts more aggressively.

THIRD-PARTY MAINTENANCE

TPMs, recently the liveliest segment of the computer maintenance and repair market, account for a growing percentage of the repair dollar. By some accounts they'll share with dealers and independents in a $1 billion slice of the market this year. TPMs like the national organizations Sorbus, TRW, Honeywell, GE, Control Data, Western Union, RCA, Xerox—everyone's getting into the act—offer what Poor describes as the "McDonald's approach to

repairs." Generally you know what to expect from them.

TPMs are becoming the choice of some large corporations since they can offer volume buyers large discounts. The more equipment a company buys, the more likely it is to look for the lower-priced TPM service. Travelers Corp., the Connecticut-based insurance company, has an in-house staff to maintain and service its over 20,000 small computers and 16 large mainframes; yet it periodically considers contracting with a TPM to take over the job; so far the price hasn't been right.

Smaller systems may not be in a big enough league to take advantage of the money savings TPMs may offer. Rates can be high for individual contractors, especially for premium on-site service, since

> ■ Computer repairs usually involve replacement of components, not really repair: the "repairer" simply pulls out the faulty component and replaces it.

you're subsidizing, in effect, the overhead of a national organization. The advantage is that you can have far-flung sites or move around the country and still find service.

Computer repairs usually involve replacement of components, not really repair the "repairer" pulls out the faulty component and replaces it. Like most computer repair services, TPMs are set up to swap boards; you may pay for more parts this way, but the labor costs are less than if the repairer took the time to fix the component. One pitfall to watch for, though, is that the replacement board is often a remanufactured board that may have different ROM chips than the newer version of the board you had in the first place. Poor cites one client whose replacement board eventually caused mysterious crash-

es, resulting in more frustrating and nonproductive downtime.

Sorbus, a Bell Atlantic company, is the largest TPM and services more IBM hardware than any other TPM. It maintains and repairs mainframes, microcomputers, and related peripherals on-site and employs more than 1,500 technical-support personnel in its 180 key locations throughout the country. Sorbus's PC service contract options include on-site, carry-in, ship-in, or van pick-up/delivery agreements for parts and labor. You can also carry in or ship in equipment for repair without a contract, on a T&M basis. In 1982 Sorbus opened its first Sorbus Stations, over-the-counter, carry-in repair centers to take advantage of the hefty PC repair market.

LOCAL SERVICE SHOPS
A new breed of computer repair services has entered the market to compete with manufacturers, dealers, and TPMs in the past few years. Business has been booming for carry-in PC repair vendors who base their services primarily on time and materials. The countrywide explosion of T&M repair shops is nowhere more evident than in the Washington, D.C., area, which ranks only second to San Francisco in the number of personal computers per capita. When Joellen Cassidy opened American Computer Repair Inc. in Arlington, Virginia, in 1983, her company was one of the first ever listed in the Yellow Pages under "Computer—Service and Repair." Only 2 years later more than 50 such listings appeared for the Washington area.

Some of these repair shops are franchise operations—Computer Doctor, Serviceland, and Computer Factory, for example. Others are mom-and-pop operations like Cassidy's service. You see them in every major metropolitan newspaper's classified listing these days. Scores of neighborhood computer repair shops are listed in the current New York City Yellow Pages.

The new retail repair chains are similar to car dealerships. No consistency is guaranteed from one store to another, and quality of service can change overnight if one repair person resigns and another is hired. If you find good service from one, be sure to get the repairer's name and home phone number in case that person decides to leave

SECRET TEST OF THE REPAIRS GAME

PC Magazine's suspicious and pessimistic editors got their comeuppance
when they found four tested repair centers
far more pleasant and competent than they expected.

We admit it: we were skeptical, pessimistic, jaded. Repair shops and services were not high on our list of trustworthy institutions.

But was everyone involved in repairs inept, inexperienced, unknowledgeable, or even dishonest? Were they all out to take unsuspecting PC owners—or at the very least to make PC users' work lives utterly miserable?

We decided to run an informal test—actually it was more like a trick. We deliberately rigged four PC disk drives by shorting out two of the pins on the connecting cable of each drive (the brainchild and handiwork of Charles Rodriguez, *PC Magazine's* staff technician). Then, incognito, blew the PCs to four repair places, one a manufacturer's service center, one a national dealer, one a repair chain, and the last a local dealer. We asked for written diagnoses and estimates—what was wrong, how much it would cost. We told our unsuspecting victims only that the unit wouldn't boot.

We expected the worst: outrageous claims that the motherboard needed replacement, that the entire unit was damaged, that we'd have to spend hundreds on labor and parts and days waiting for a repaired disk drive. We thought we'd encounter surly, semiliterate, even smelly repairmen who crouched behind dusty machinery, seldom emerging during the light of day. Or would we be greeted by gum-snapping, hairspray-drenched receptionists with nary a nodding acquaintance with the PC?

Our jaded imaginations conjured up all sorts of atrocities: lipstick- and oil-smeared bills for outrageous sums; cash or only some arcane credit card accepted in payment; patience-defying waits in serpentine queues, lined up with the likes

of the guests at the Mad Hatter's tea party; clerks waiting to cut off our heads like the Red Queen's henchmen; circuitous, logic-defying dialogues with repairmen metamorphosed into the Cheshire Cat; weeks spent down a dank, dark rabbit hole, incommunicado with our PCs as they sat enshrouded in dust on the repair shop shelf; even more scary, the thought of having to put the machine, like Humpty Dumpty, back together again when all the king's horses and all the king's men wouldn't go near such a thing. . . . Yes, we shivered gleefully at the expected horrors of our self-inflicted trials.

> ■ To run an informal
> test, we rigged four
> PC disk drives by
> shorting out two pins on
> the connecting cable
> of each drive.

In fact, executive editor Paul Somerson depicted many of these horrors in real-life detail just over 2 years ago (*PC Magazine*, Volume 2 Number 5). His experiences go beyond any of those mentioned here—previously unimagined levels of ineptitude. As he said then, "Why, I could tell you stories that would curl your cables, all dead true." Somerson is a repairs raconteur of the first order, and so his words made a deep impression. But, as we momentarily forgot, the past 2 years in the computer business have seen eons' worth of change. The repairs game

is not what it once was.

We admit it: we were wrong. The *PC Magazine* tricksters all came back from dropping off the sick PCs impressed with the places they had taken them. They told of clean service centers and friendly, reassuring clerks and repair technicians. The fees for determining the problem and estimating the costs ranged from $29 to $82.35. A few days later we had the four estimated costs for repairs, ranging from $81.70 to $153.99, and the diagnoses.

The surprise was that every place we took our "broken" PCs, the technicians quickly discovered what was wrong and correctly diagnosed the problem, without adding on costs for additional repairs! How skeptical we had become, but we were relieved and delighted to see how far the PC repairs business has come. (All four places we took the PCs passed the test, but a Computer Factory branch on Long Island and a Computer Doctor branch in Manhattan got especially high marks from the PC staff member who took his PC there.)

Our good news about the results of this test doesn't mean that you can let down your guard against shoddy service, though. Remember *caveat emptor* and all the advice that goes along with it: researching the best available repair sources, documenting the problem beforehand, getting all estimates in writing, practicing all the dos and don'ts of the well-informed consumer. Good PC repairers can become even better ones if you keep them on their toes.

We certainly missed the mark when we prejudged all PC repairers as incompetent, overpriced—even crooked. We've had to reevaluate some of our outdated, perhaps insular, biases. But sometimes it's nice to be wrong.—*Carol Olsen Day*

for another job or to go into business solo. As with car repairs, it pays to get to know your Mr. Fix-It.

Independent computer repairers are taking part in the boom too. They may work out of their homes, a small office, or share space with other small service businesses. Some of the best independent repairers work days for manufacturers or the larger repair services and moonlight. You may hear of them most frequently through word of mouth. Wherever you get service, the repair person who actually does the work is usually the most important element and what determines its success or failure. So keep on a constant lookout; ask everyone you come in contact with who might know someone. Your queries and vigilance can pay off in more reliable, faster, or less costly service.

IN-HOUSE REPAIRS Another service option for businesses is to hire an in-house maintenance and repair person or, if volume demands, an entire staff like that of Travelers Corp. With its large mix of equipment (expected to grow to 25,000 PC units by 1990), Travelers has found that handling most repairs in-house is less expensive. Thomas M. Ottman, vice president of data processing, estimating on the conservative side, says Travelers' in-house staff can handle the job for about $75 per machine per year, while TPMs Travelers has consulted quote a cost of about $350 to $500 per machine per year. Ottman claims his unit can handle the job better, with faster turnaround, more individualized attention, and most importantly, more flexibility than any TPM. The dollars Travelers saves this way each year, Ottman says, mean that it can invest in more PCs to serve its in-house customers better.

In-house service is less practical for companies with units spread out across the country, but it can pay off, even for companies much smaller than Travelers. IDC's Shugan says that to get the benefits from an in-house service, you should have at least 100 units of equipment. (One example of that size operation handling PC repairs with its own in-house technician is The Johns Hopkins University Department of Medicine Oncology Center in Baltimore.) Shugan advises that you analyze your re-

pair costs. How much did you spend on labor last year? What did you pay out for service contracts? He claims you could find a good technical person for your staff for around $20,000 to $25,000 a year. Another option would be to hire someone part-time or to share a repair person with another company that has a similar need. (Remember though that you'll have to spend some time managing in-house repair, as with any employee unit.)

In-house repair has its own set of problems. When you're but one small user in a large company that relies on in-house repair, you may find yourself wondering if going outside the company for service isn't a better idea, especially when you find yourself last in a long line of people requesting repair service. You might have to

> Wherever you get service, the person who actually does the work is usually the single most important element in determining the work's success or failure.

cultivate a good relationship with the support team to call on in case of an emergency. Favored "customers" may be able to bump those ahead of them in the service queue.

If your business involves just a small amount of equipment, consider the money you'd save by becoming your own in-house expert. Or what about encouraging a current employee to take on the repair function? If you or someone on your staff has an interest in do-it-yourself-type projects, try setting up an in-house capability for maintaining and repairing your equipment. Books like *The Complete Computer Maintenance Handbook* by David Bellin (Harper & Row, 1986), *The Plain English Maintenance & Repair Guide* by Henry E. Beechhold (Simon & Schuster, 1985), and

Repair and Maintenance of Your IBM PC by Gene B. Williams (Chilton Book Co., 1984) can explain the basics and get you started. Courses at local schools and community colleges are worth exploring, too (the instructors also can be a good source for finding out about people and places who can do reliable repairs).

GAME PLAN: KNOW THYSELF With more and more people ready to take your money to do the job and more and more options for kinds of service, how do you choose the best solution? There's no way out of it: you've got to do your homework first. Next to prevention (which *PC Magazine* will cover in an upcoming issue), planning is the most important step to make sure you get the best service for your time and money.

As in any endeavor, when planning for the worst—hardware breakdown—Shakespeare's advice holds up once again: "To thine own self be true." How well do you know your needs and your resources? Find your solution by analyzing your demands. Ask yourself:

● How much and what type of equipment do I have?
● How long have I had it?
● What applications do I perform? How dependent on time is their completion and success?
● How long can I afford to have equipment out of order?
● How adept am I at preventive maintenance and do-it-yourself-type repairs?
● How accessible is stand-in equipment, either leased or borrowed?

Service contracts are not the best buy for most small business and home users. But if your equipment is no longer covered by the manufacturer's warranty and your business cannot afford downtime for 2 to 3 days, you should have either a service contract with a reliable vendor or the services of in-house repair unless you have backup equipment available. For example, as Alfred Poor says, "If you've got a single essential system for a time-dependent application like getting out the payroll for a big company, with no parallel system to handle the job in an emergency and a relatively small time window, then you can justify the cost of on-site turnaround offered by a service contract."

INFANT MORTALITY Most equipment that's going to fail will do so in the first 90 days of its use. Bosworth calls this type of failure "infant mortality." So make sure that you use your newly purchased equipment right away. Keep it on for hours at a time, even overnight, and use it to the fullest so that if, for example, as Poor says, "the chips are going to burn out, they burn out before the warranty is up." David Bellin, author of *The Complete Computer Maintenance Handbook*, concurs: "After the first 6 months, the odds will be on your side if the contract is dropped." Bosworth advises that if you can tolerate 2 to 3 days without the use of the hardware, a service contract won't be that useful to you over the first 1½ years. After about 18 months, service contracts become more advisable if the hardware replacement costs are higher than the cost of the service, which, Poor says, ranges from ½ to 1½ percent per month (some cite 12 to 20

■ Keep your new machine on for hours. Use it to the fullest so that if, for example, the chips are going to burn out, they burn out before the warranty is up.

percent a year) of the purchase price of the equipment, whether from manufacturers or TPMs. "Over a couple of years," Poor notes, "you could spend half again as much as the system."

The additional reliability that manufacturers are building in to new hardware products makes it easier to forego the security blanket of the service contract. And Poor says that the fact that IBM is offering a full year of service in its warranty for the AT raises the user's confidence. "If you're really worried about hardware failure from a financial rather than a time standpoint," he says, "find out how much money you'd have to spend for the protection of a service contract. Then put it in the bank instead of in the vendor's pocket. That way you'll know you'll be covered if something breaks down."

Printers are frequently mentioned as exceptions to the rule. They're notorious for problems, since unlike CPUs, they have many mechanical parts that can malfunction. So you want to purchase a service contract for any high-cost, high-demand printers you own and use the T&M approach for the rest of your equipment.

CHOOSING A CONTRACT If, after analyzing your need for fast turnaround and the convenience of a service contract, you decide you should purchase one, your next task will be to decide what kind of ser-

vice you need. You can choose the premium on-site service (the repairer comes to you to do the repairs within a specified amount of time ranging from about 4 hours to 24 hours), pick-up service (the machine

is picked up, taken to the shop and repaired, then returned to you), or carry-in service (you do the delivery and pick-up). Another alternative is mail-in service, which comes in two types: You identify the problem, remove the offending component, and notify the vendor to send you a replacement component by overnight freight while repairing the broken one; or you mail your computer to the vendor for repair. Few experts, however, recommend this option because it requires expertise in diagnosing problems and takes too much time.

As with any contract, read the fine print carefully. Attorney L. J. Kutten (*Computer Buyer's Protection Guide*, Prentice-Hall, 1984) outlines some important con-

■ See if you can figure out where your sick PC's problem is. If you can document what's wrong, you'll be better able to describe the problem to the repair people.

siderations to be aware of before buying a service contract:
• When does the coverage begin—immediately or after the manufacturer's warranty expires?
• What exactly does the contract cover? (As with all of the answers to these questions, be sure to get everything in writing.)
• Can you purchase the contract after you have had the equipment for awhile? If so, do you have to bring it in for inspection at an additional cost?
• How much does the contract cost after the first year? Can these prices be raised?
• Can renewal be refused? If so, why?
• If you sell the equipment, is the buyer covered?
• Must your entire system be covered? What if you add or delete hardware?
• Will you be given a loaner if the equip-

■ REPAIRS

ment takes longer than a certain time for repair?

GETTING SERVICE ON YOUR OWN
If you've decided to bank the money a service contract costs and use it for the day when your own hardware actually fails, be sure to take a few precautionary steps before and while bringing the equipment into a repair shop. First, make sure the problem is actually the hardware and not your software or, frequently the case, what one repair technician calls "pilot error." Run through your connecting, booting, and startup procedures again. Try the diagnostics program. See if you can figure out by yourself where the problem is. If you can document what's wrong, you'll be better able to describe the problem to the repair people.

Bring all necessary cables and software related to the problem into the shop with the defective equipment. Even if you're sure they're okay, you want to be able to demonstrate the problem you've been having as accurately as possible.

And don't forget everything you know about good consumer practices like getting a written estimate first. You may also want to take the equipment to another shop for a second opinion (especially if you're not familiar with the work of the repair technicians you're consulting). Once you agree on what's to be done, be sure you know what the charges will be and how much time it should take. Ask if a loaner is available while your equipment is being repaired. Again, get all charges in writing.

In regard to loaners, it's a good idea to find out ahead of time where you can rent equipment when yours goes down. Call around and find out which company offers the best rates. Can you apply a percentage of the rental cost toward purchase of new equipment? Is there a price break for renting for a longer amount of time? What kind of credit do you need to rent equipment from various vendors? What's the payment arrangement? How much time elapses between making the call requesting a rental and receiving it? Does the rental company charge for pick-up and delivery? Make arrangements ahead of time to ensure that you know the best place to rent replacement equipment and that you'll get the best service possible.

Wherever you go for service, get the best deal you can, and that doesn't always mean the lowest cost. Reliable, well-informed, timely, and courteous service can be more valuable than low-cost service. How do you find out where to go for reputable service at reasonable cost? User groups, local bulletin boards, and repair course instructors can be good sources of recommendations. Also, ask computer stores that do not have service departments; they're likely to be able to recommend someone you can trust.

Until the day of completely disposable parts, computer repairs are a fact of life. Ever since William Butler Yeats wrote,

■ **Wherever you go for service, get the best deal you can—and that doesn't always mean the repairs with the lowest cost.**

"Things fall apart; the center cannot hold," after World War I, people have been echoing his sentiments, especially about things mechanical.

So when it comes to repairs, let your motto be "Be Prepared." Plan now so that you'll know whom to call on that inevitable day when something goes awry. In sum: Shop around. Look closely at any contract you sign. Get estimates from various vendors—in writing. Ask for references so that you can check with other customers before you commit yourself when trying a new vendor. Be a fully informed consumer. Line up places to rent or borrow equipment in a pinch. Make sure you've done your homework. Play the repairs game to win.

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SOLOMON III

SOPHISTICATED MULTIUSER ACCOUNTING

Over a year ago, in the January 22, 1985, issue of *PC Magazine* (Volume 4 Number 2), we reviewed the *Solomon III* single-user accounting system by TLB Inc. At that time we called it "the most sophisticated accounting software currently available for the PC." On November 4, 1985, TLB released multiuser *Solomon III* for use with Novell's *NetWare/SM-2* (ARCNET) and *NetWare/E* (EtherLink) local area network operating systems. This new version provides for a sophisticated multiuser accounting system environment. Again, we believe, *Solomon III* sets the standard for personal computer accounting software.

With multiuser *Solomon III*, up to seven people can be signed on to an integrated accounting database using any of the *Solomon III* accounting modules. For example, seven individuals at a time can enter invoices into Accounts Receivable. Alternatively, they can all work in any of *Solomon*'s 13 other accounting modules, including General Ledger, Accounts Payable, Purchasing, Order Entry, Inventory, Payroll, Job Costing, Fixed Assets, Sales Analysis, External Systems Interface, Database Reporter, Tutorial & Support Plan, or Address & Mail list. Record-locking facilities prevent any two users from updating the same record at the same time. System integrity is maintained to prevent, for example, two users from concurrently updating the record of the same vendor or posting to the General Ledger while financial statements are being prepared.

The operational or functional differences between single-user and multiuser *Solomon III* are minimal. In fact, if you are familiar with the single-user version, the transition to the multiuser version will be so painless as to be nearly unnoticeable.

64-MEGABYTE DATABASE Along with a new database format, *Solomon III*'s maximum database size has been increased from 12.6 megabytes to a healthy 64 megabytes. However, TLB recommends that you not exceed 30 megabytes because system response time will suffer. This increase from a 12.6- to a 30-megabyte database makes *Solomon III* a reasonable alternative for a significant new group of users. We've begun to see sizable businesses choose *Solomon III* to address their financial accounting and reporting needs. However, we strongly recommend that, prior to purchasing this product, you get a certified *Solomon III* dealer to estimate the size of your database from your current and future (estimated) transaction volumes.

The multiuser version also provides for spooling of your printed output and offers the choice of printing to a system or local printer. Print spooling allows several users to send print-job requests to the system printer(s) at the same time. The file server processes these requests and stores the output file in a printer queue until the system printer becomes available. You regain

Once again, Solomon III sets the standard for PC accounting software with its multiuser version. It works with Novell's Netware/SM-2 and Netware/E LAN systems.

control of the workstation as soon as the print job has been calculated and the output file created. There's no waiting for your print job (and any that may be in front of it on the queue) to conclude before getting back to work with the program.

The system's response to a request for printed material is: "Do you want to print to a system printer (Y,N)?" If you respond affirmatively, *Solomon III* prompts for the system printer number because you can have up to three system printers on a single file server. Once you enter the printer number, the program processes and spools the print job and returns control of your workstation to you. The Novell *NetWare* operating system allows you to run both serial and parallel printers from the same file server. Novell print spooling allows an individual user to control print requests from his own PC as needed. You can view print number, status, form type, job sequence, print filename, banner specification, number of copies, print format, and job print time at any time. Users can also cancel their own print jobs.

FREE E-MAIL Novell *NetWare* includes the Novell *Electronic Mail System* at no cost. You can set up the system so that when you log on, you are informed if you have received any electronic mail at the time. You can issue standard messages to all those who log on to the system based on predefined criteria. For example, if the system date is set to Monday, the system can display: "It is Monday, and your staff utilization report is due by 11 a.m." In addition, you can easily send messages from one workstation to another. These messages create an audible beep and appear at the bottom of the screen. They can be sent to one or many workstations, including the file server. This can certainly enhance intraoffice communications but may give the company controller nightmares. Sending a message from a workstation to the file server while logged into the *Solomon III* system will cause the database to crash. Fortunately, this can be avoided by disabling your file server's ability to receive messages when you power it up.

CONFIGURATION TLB is quite specific about its configuration requirements. You must use an IBM PC AT with 512K

■ We've begun to see sizable businesses choose *Solomon III* to address their financial accounting and reporting needs.

bytes of RAM as a file server and DOS 3.0 (3.1 will be supported soon). Workstations may be any combination of IBM PC, XT, AT, Compaq, or Compaq Plus. Each workstation must have at least 384K bytes of RAM. You may use Novell *NetWare/E* (EtherLink), Version 4.61 or 4.61a, with 3COM EtherLink Interface Cards or Novell *NetWare/SM-2* (ARCNET), Version 4.61 or 4.61a, with ARCNET PC-LAN Boards (Novell *Advanced NetWare* is due to be supported soon). If you use *NetWare/SM-2*, you will also need to purchase a "passive hub" (for up to three workstations) or an "active hub" (for four or more workstations). You need to use coaxial network cables to hook your file server and workstations together. Also, make sure you check your local building codes to determine if you need to use a special type of Teflon-sheathing. We did.

Of course, you'll need to purchase the multiuser *Solomon III* System Manager, the General Ledger module, and any other accounting modules you require.

System and local printers may be serial, parallel, or any combination of both. However, you should discuss this matter with your certified Novell dealer to assure proper configuration. In addition, we strongly recommend that you invest in a tape backup unit (see "Tape Backup: Measuring Speed and Cost per Megabyte," *PC Magazine*, Volume 5 Number 3). And, if your area is subject to electrical power fluctuations or outages, you should consider installing an uninterruptible power source (UPS) on the file server and each workstation. (Watch for upcoming reviews of power conditioning hardware in the May

27, 1986, issue of *PC Magazine*.)

Some of Novell's cabling limitations include a maximum of 100 feet from a passive hub to the file server or workstation, a maximum of 2,000 feet from an active hub to the file server or workstation, and a maximum of 22,000 feet of cable in the total network. Again, you should discuss your planned configuration and its potential limitations with a certified Novell dealer.

TWO-STEP INSTALLATION The multiuser network installation involves two separate phases: installing the Novell network and installing the *Solomon III* multiuser system. Many of the accounting systems that we've reviewed in this series feature what we call "slam-dunk" 1-hour installations. Just shove in the floppy and type INSTALL. Well, believe us—LAN-based multiuser systems bring you into the big leagues. You've got to be prepared to do some considered planning. Get out

The Price Waterhouse Team

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your screwdrivers and wire snips, here it comes!

The network hardware installation requires more time to plan than to actually install. You must decide where in your office to locate the file server and the workstations in a configuration that conforms to your office environment. Cabling requirements may also determine the placement of your network. Communications board installation requires that you set a few switches and jumpers on the board and then install one board in each workstation and file server. You must also install a "keycard" in the file server. This is a short card that must be in place for the Novell operating system to function.

Once the network hardware is in place, you must prepare the network file server's hard disk. A *NetWare* installation utility program smoothly guides you through the setup of your hard disk, including a check for bad blocks and an "overnight" comprehensive disk surface test (Compsurf) that performs random read/writes to the disk. This test identifies bad blocks on the hard disk and adds them to the operating

system's bad-block table so that no data will be stored in these defective areas. We let this process run for 18 hours, in which over 700,000 read/writes were performed. One note of caution: When beginning the Compsurf program, you will be requested to enter known bad-blocks from the manufacturer's bad-block table that accompanied your AT purchase. If you too have misplaced this piece of paper, you

■ THE PRICE WATERHOUSE REPORT

should respond to the system's request with a "dummy" bad block (Novell recommends cylinder 38, head 2). In our first attempt, we entered no bad blocks and encountered a bug in the Compsurf program, which made all further testing useless. The final tasks necessary to complete your network installation include running DOS's FDISK program and copying the *NetWare* programs onto the file server.

Once your file server installation is complete, you are ready to begin installing the *Solomon III* system. You must install all applications through a workstation. Boot disks need to be copied for each workstation from the *NetWare* PC Boot disk, along with the AUTOEXEC.BAT file (renamed from the SOLEXEC.BAT file on the *Solomon III* install disk).

Solomon III's automatic installation program offers the option of creating your own directories and DOS path environments or accepting the default settings provided. We found the default directories and subdirectories to be satisfactory—reducing a potentially lengthy task into a 1-minute affair. The installation program then prompts you to load the original *Solomon III* floppies one after another. You may install all of the applications modules you purchased now or load only the General Ledger and install the rest later.

The final installation task is to set up the network security privileges, as discussed below.

THE SYSTEM ADMINISTRATOR Installing a multiuser accounting system creates the need within your company or division for a new position with new responsibilities—the system administrator. The administrator is the individual responsible for completing tasks like powering up and down the system, setting up directories and network utility programs, and maintaining the computer security system. The system administrator's job has become necessary because the computer environment has become more sophisticated. For instance, you must start and stop database communications between the file server and the workstations whenever a database or log file backup is required. Database access numbers should be recorded and monitored in order to identify particular work performed and to maintain a clean

audit trail. Single-user *Solomon III* creates log files by recording keystrokes; the multiuser system provides a more sophisticated log file, based on transactions. This type of log file should prove more reliable since it doesn't record erroneous keystrokes that can cause terrible problems during the reconstruction of a database.

Although the software allows multiple users to access the same database, you will occasionally be locked out of an operation because another user is currently updating the same record or group of records required by your operation. For example, you may have to wait if you attempt to print a report that contains a record being updated by another user. The system administrator should consider scheduling certain tasks in order to minimize this type of conflict. The *Solomon* system administration manual is very helpful in this regard, providing work schedule tables (by module) to show you which functions will cause delays if run concurrently.

SECURITY There are two security systems in place with the multiuser version because both Novell and TLB provide their own security schemes. Novell *NetWare* provides the system administrator with extensive facilities to create a security system as simple or as sophisticated as desired. Privileges can be granted to individual users or groups of users. These privileges include read, write, open, create, delete, search, and modify. Using a log-in password scheme, access to directories can be controlled, and through the selective granting of privileges, users' ability to read, write, and so forth, can be limited.

Once you have successfully logged onto the Novell network, you must sign on to the *Solomon III* system. The multiuser version employs the same password protection scheme as the single-user version. Access can be controlled to the screen level by the sign-on password. For example, a user with the password "Orange" may sign on to the General Ledger and have access to the journal entry screen but be prohibited from printing financial reports.

Both the Novell and *Solomon* security systems require that you set up a "master" user password. This is then the only password that provides access to the password maintenance function.

DOCUMENTATION AND USER SUPPORT At the same time TLB released *Solomon III* multiuser, the company introduced a new format for documentation for the single and multiuser *Solomon III* prod-

uct line. The new documentation consists of separate manuals for each accounting module plus a new module called The Solomon III System Manager. The new documentation is compatible with all current

versions of *Solomon III*.

The one-book-per-module format is a big improvement over the old system, as the single binder for these capable systems was becoming unwieldy. TLB has expanded its coverage of each module and includes a "procedures" section for each module. The procedures addressed in these sections offer guidance on organizing your accounting paperwork to complement the *Solomon III* accounting software. Each procedure provides a step-by-step guide to the activity, detailing each step, with a recommendation as to who should perform each step, and to the *Solomon III* screens and reports involved.

The Solomon III System Manager module comes with two volumes: *System Administration* and *Understanding Solomon*. The *Understanding Solomon* manual contains general information needed for the operation of the *Solomon III* system and should be required reading for any new *Solomon III* user.

Other enhancements to the documentation include expanded coverage of screens and reports, appendixes on coding schemes relevant to the module, and an index in each manual.

Users of TLB's single-user system may purchase the new system's documentation for $25 to $35 per module for all modules except for the System Manager, which costs $65. In addition, all users who have purchased modules since January 1, 1985, will be sent a technical bulletin detailing the new documentation. They will be able to order manuals for all modules they have unlocked plus the System Manager directly from TLB for a total cost of $95.

Also new is a forms disk. This disk can be used to print out the required forms for all modules. The forms replicate the data entry screens and should make your hard copy more useful and manageable.

TLB seems to recognize that, with the added sophistication and complexity of its multiuser version of Solomon, its success is dependent upon your dealer's knowledge and experience with LANs, particularly Novell's *NetWare*. Anyone wishing to become a *Solomon III* multiuser certified dealer must first provide TLB with proof of successful completion of both Novell *NetWare* and *Solomon III* multiuser required training courses. This is good

news for accounting professionals who use personal computers.

"Teleconsultation" support from TLB is available to those who want to work directly with the developers of *Solomon*. To use this teleconsultation service, you must be a registered user of a *Solomon* product and have authorized TLB to bill your charge card at a standard $72-per-hour rate, with a 5-minute minimum charge.

If you want to use *Solomon III* but need to have the software customized in certain minor ways (such as adopting a special invoice format, preparing custom reports, or changing field names on screens), TLB will contract with you to do so. To initiate this type of work, you must be a teleconsulting user and be willing to pay TLB for the time required to prepare the customization specification and contract, whether or not you then choose to have the company go ahead with the work.

TLB's customer education group offers courses such as "Using Solomon," a 2-day training seminar. This seminar covers the General Ledger, Accounts Payable, Accounts Receivable, and Payroll modules in detail. Topics include system-wide installation procedures for single and multiuser *Solomon*, operational procedures, conversion guidelines, and optimal use of *Solomon*'s features. The instruction is given by TLB branch managers and *Solomon* certified consultants.

CONVERSION FROM SINGLE-USER SYSTEMS Many of those interested in using multiuser *Solomon* may already be familiar with the *Solomon III* single-user system. (We were told that there are over 10,000 existing single-user installations.) To address the needs of those wishing to upgrade to the multiuser version, TLB created a utility program that converts a single-user database into a multiuser database. This program takes each record from your single-user database and converts and copies it into a multiuser database. You need enough hard disk space to hold both databases at the same time. Even though this function is automated, it takes some time. Plan on a 7-megabyte database taking about 3 days to convert. This process cannot be interrupted, so you may want to run it over a weekend.

TLB is offering current *Solomon* users dollar-for-dollar trade-in credit against the price of *Solomon III* multiuser. To upgrade, you must purchase these items from your dealer: the *Solomon III* System Manager/Novell module ($1,295), the *Solomon III Database Conversion Kit* (Version X.12 for Novell, $95), and manuals for all modules you wish to upgrade. You simply complete the forms found in the *Database Conversion Kit* and send them along with

your original single-user disk to TLB. The company will send you the disks necessary to complete your system upgrade.

Such a conversion is not so easy for some *Solomon III* users. We've worked with businesses using two or more non-networked machines to run multiple *Solomon III* applications on an application-per-machine basis. This allows you to use multiple machines as data-entry stations. Solomon's single-user General Ledger consolidation function provides the means of pulling all this data together into a single General Ledger database.

If you are using this type of multiple-machine single-user system, your conversion to a multiuser system will be a greater burden. First, you will need to use the standard *Solomon Database Conversion Kit* to turn your General Ledger database into the multiuser format. That's easy enough. The problem is with the other modules that reside on separate PCs. You must manually convert data from your other modules, incorporating them into the multiuser database you have just created. At this writing, there is no utility for pulling data out of secondary machines for conversion into a separate multiuser database. We spoke with product managers at TLB about this problem, and they told us that they are currently working on a utility that will, at a minimum, allow nonfinancial master records to be transferred from secondary databases. When this becomes available, you would have to enter and tie out only the financial detail such as open payables vouchers and receivables invoices.

As with any such system, there are limitations that shouldn't be overlooked. First, only one database can be active on the file server at a time. This means that if one user is signed on to the production database, another user may not sign on to a test database for training or practice.

Second, the *Solomon III* installation instructions need to be improved. We found the instructions somewhat cumbersome, and some appeared to be out of sequence. The 53 pages of instructions could be replaced by 9 to 10 pages of required steps. We discussed this with representatives from TLB's support group, and they said they plan to issue such a document.

Our original review of *Solomon III* was very positive, and we remain impressed

with the functionality packed into TLB's accounting modules. Now, with the company's multiuser option (and larger data capacity), these systems represent an alternative that a small business should not

overlook. We believe that many will find the benefits of multiuser concurrent processing to be worth the expense and effort. —**G. William Dauphinais, Pat Fitzhenry, and Jeffrey Williams** ⊠

Quick-Change Artist

Introducing AST-3G—"The Adaptable EGA Solution For Color And Monochrome High-Resolution Graphics And High-Quality Text.

The new AST-3G Enhanced Graphics Adapter (EGA) gives your IBM® PC/XT/AT or compatible all the colorful adaptability of a chameleon at a price that's going to make the competition turn green.

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CHOOSING AND USING MODEMS

Using the power of the near-universal AT command set and calling on little-used batch files are two simple tips to help you get the most from your modem.

Being able to communicate and to exchange information with other computers by modem can markedly expand your productivity. While many users already understand the basics of hooking up modems and transferring data, the intricacies involved often trip up the newcomer.

Here's an overview of modem communications, with some hints for getting more out of your modem, including an easy way to call home with only a few keystrokes—without an autodialer or modem program.

HAYES: THE DE FACTO STANDARD The Hayes Smartmodem is the de facto standard for modems, and at $599 list for the 1200 external it's true that you're paying at least partly for the name. Other reputable makers include Microcom, Racal-Vadic, U.S. Robotics, and IBM. U.S. Robotics is the cheapest of the group ($449), IBM the costliest ($609), and Hayes the easiest to get (less than $400 discounted). Ven-Tel, Bizcomp, and Qubie are also well-known names in the field.

Internal modems cost $50 to $100 from the price of their external counterparts and often include communications software. The internal Hayes 1200B Smartmodem costs $549 (with software); IBM's PC 1200 External Modem is $599 (no software).

Too expensive? Hayes-compatible internals include models from Practical Peripherals, $199; CTS, $175; and PC's Limited, $159. (CTS sells 2,400-bits-per-second internal or external modems for $375.) None of these have yet been tested by PC Magazine Labs, but don't

rule them out because of price. Modems are pretty simple beasts. Do check the warranty, though. Hayes offers 2 years.

One specialty modem of interest is the external Prometheus ProModem 1200. If you add its optional communications buffer, the ProModem functions as an electronic mailbox that will receive and send messages even when your computer is off ("Buffers That Boost Communications Potential," *PC Magazine*, Volume 4 Number 23). The Hayes Transet 1000 (same issue) adds to nearly any modem a similar standalone capability for incoming mail.

HAYES COMPATIBILITY The claim of "Hayes compatibility" is a common source of confusion. You don't need a Hayes-brand modem to talk to another Hayes modem. You don't even need a Hayes-compatible modem. As long as they meet the electronic requirements im-

> ■ The Hayes "standard" is important because so much communications software uses the Hayes command set (also known as the AT command set).

posed by the Bell 103, Bell 212, and V.22 bis protocols for 300-, 1,200-, and 2,400-bps communications, respectively (see sidebar "Protocols") and—virtually all modems sold for PCs do—you're all set.

The Hayes "standard" is important because so much communications software uses the Hayes command set (also known as the AT command set). Even IBM uses it. It's not that the Hayes command set is superior. It's just that more communications software is written for it. (Some programs also handle additional command sets.)

What is the AT set? Whenever you type a capital AT, a Hayes-compatible modem knows that what comes next is an instruction for the modem. For instance,

    AT DT 1 2Ø2 456-1414 <Enter>

tells any Hayes-compatible modem to come to attention (AT), dial (D) using tone dialing (T), and call the White House.

SOME ARE MORE EQUAL THAN OTHERS Alas, some Hayes-compatible modems are more compatible than others. PC Labs benchmark tests have shown a high degree of compatibility from Microcom, U.S. Robotics, IBM, Promethcus, and OmniTel products, but even in this group some modems won't work with some programs, so the best policy is to test before buying.

Even modems with the full Hayes command set may have timing differences or other hidden incompatibilities. The best test is to try several communications packages and the autodial function in *SideKick*.

Protocols

Word gets around—in the United States as well as abroad—by means of protocols.

In the United States and Canada, most PC modems observe one of three protocols, which are defined in part by how fast they run. There is a second set of protocols for the rest of the world, called the CCITT protocols, recommended by the International Telegraph and Telephone Consultative Committee.

• Bell 103 protocol for communications at 0 to 300 bits per second, about 0 to 30 characters per second. Although they're in a number of laptop portables, as standalones, these modems are painfully slow for any but the most casual users. The contents of a single 360K floppy disk would take almost 2½ hours to transfer.

The CCITT counterpart 300-bps protocol is V.21 (pronounced Vee dot twenty-one). Bell 103–compatible modems absolutely cannot communicate with V.21 modems; the protocols are too different.

• Bell 212 protocol for 1,200 bps, about 120 characters per second. If you already own a modem, odds are it's Bell 212–compatible; that's the standard in the business world. They list for $200 to $600.

The European counterpart is V.22. Bell 212 modems in the United States can theoretically communicate with V.22 modems in Europe because the protocols are similar. In practice, there are often problems. The link is usually easier to establish if you're calling from this country. A handful of modems built since late 1985, most notably the Hayes 1200 and 1200B units, offer both protocols.

• V.22 bis protocol for 2,400 bps, about 240 characters per second. This

may be the modem of the near future (unless 2,400 bps is leapfrogged by 9,600-bps modems). For most users, this newer, more expensive "standard" isn't widespread enough to be worthwhile—yet. Modems in this category typically list anywhere from $600 to $900, and their best feature is the price pressure they put on 1,200-bps modems.

If you travel overseas, you cannot bring a Hayes or other United States–approved modem with you and hook it up to the European phone lines—at least not legally. Just as modems require FCC approval in the United States before they can be used, so do they require equivalent approval in other countries. Canadian standards are similar to those here, but in Canada also, modems require specific approval before they can be used.

SOFTWARE PROTOCOLS Another set of protocols helps ensure against errors during file transfers.

The public-domain Xmodem protocol is the most widespread and closest to being a standard. It's also known as the Christensen, CP/M User Group, or MODEM7 protocol. Most software packages include Xmodem.

Kermit is another public-domain protocol that is becoming more widespread.

Many programs (*Smartcom II* and *Crosstalk XVI*, for example) offer proprietary protocols. These work only if you have the same program operating on both computers.

More-sophisticated protocols vying to become the new standard are MNP by Microcom and X.PC by Tymnet. The jury is out on which one—or both—will come out on top.—M. David Stone

ing the phone, logging on to a system, asking for information, saving the information to disk, and logging off. *Microsoft Access*, *Relay Gold*, *ASCOM IV*, and Microsul's yet-to-be-released *Crosstalk Mark 4* lay claim to being a new generation of communications software that offer background file transfer.

PC-Talk III is available as freeware ($35 to the authors if you like the program) and is the least you should demand in a communications program. Its features include standard from a built-in phone directory, semiautomatic log-on with programmable function keys, and error-correcting file-transfer capabilities using the widespread Xmodem protocol.

IBM includes with DOS a simple but workable communications program, COMM.BAS, that allows your PC to function as a dumb terminal. Using COMM.BAS you can issue commands to a smart modem, but you can't save anything to disk that you receive from another computer.

REMOTE OPERATIONS A new and growing category of communications software is the remote-operations program, which lets you call your PC from elsewhere and run programs on your system. Programs include *Remote* (for calling from virtually any computer), *pc ANYWHERE* (similar to *Remote*), and *Carbon Copy* (which is currently the best choice for calling PC to PC).

CONNECTIONS Connecting an internal modem to a PC is mostly a matter of plugging the board into an empty slot. Just make sure you have it set for a vacant communications port. If either COM1 or COM2 is taken, simply assign the modem to the other COM port, usually by setting a DIP switch on the modem board or by moving a small jumper connector on the board from one set of pins to another.

If the modem is the only communications device in your system, it doesn't matter which COM port it is set for, as long as you remember to set your software appropriately. Having the modem and another serial device set for the same port won't do any damage to the system, but it will keep the modem from working. (This same consideration should be applied when you're

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Try out the modems with *Crosstalk XVI*, *Omniterm 2*, *Smartcom II*, *Relay*, *Relay Gold*, or *Microsoft Access*. When testing for Hayes compatibility, install each program for a Hayes Smartmodem, then try using the program's autodial feature to es-

tablish a connection. Unless the modem works with all the programs, it's not 100 percent compatible.

Relay, Microsul's *Crosstalk XVI*, and Hayes's *Smartcom II* handle unattended operations for such complex tasks as dial-

connecting an external modem.)

To connect an external modem to a PC serial port or to the serial port that comes with nearly any multifunction board, you need an RS-232C cable with a 25-pin DB-25 connector that's female at one end (IBM end) and male at the other (modem end). The cable should be wired straight through with no pins crossed. (Technically, the PC and its multifunction boards are Data Terminal Equipment (DTE) that send data on line 3 and receive data on line 2. Modems, on the other hand, are Data Communications Equipment (DCE); they receive data on line 3 and send on line 2.)

Usually, indeed, all you need is a cable with pins 2 and 3 for data plus line 7 (the signal ground) and possibly pin 1 (a protective chassis ground). Be aware, however, that some communications software—notably *Crosstalk XVI*—wants to see other pins connected. Thus the safest approach is to wire all 25 lines straight through.

The PC AT uses a 9-pin DB-9 connector rather than a DB-25. The 9 pins are sufficient because most of the 25 lines in the DB-25 aren't used anyway. IBM and others sell DB-9 to DB-25 converter cables.

You can buy a fully shielded (from interference) cable for about $50. Any Radio Shack sells a nonshielded ribbon cable for $20, or you can buy a ribbon cable and two connectors for a dollar or two less and press them together.

CONNECTING TO THE PHONE LINE

Most modems plug directly into a wall jack using the same miniature connector that a standard RJ-11 phone jack uses. Multiline phones that go through a switchboard may use RJ-12 or RJ-13 jacks. These look identical to the RJ-11 but have different wiring. Some modems can be set for any of the three; others work only with the standard RJ-11.

Some modems have a second jack for the phone. If not, buy a two-way RJ-11 adapter at Radio Shack and plug both modem and phone into the telephone outlet.

MODEMS WITHOUT SOFTWARE

Most modem commands are given through software, but you can also communicate with your modem directly from DOS by using batch files or commands copied from the keyboard (CON).

First step, initialize the communications port. From DOS, for a 1,200-bps modem, type

```
mode com1:1200 <Enter>
```

The MODE command sets the system to send data out the COM port. For the second port, substitute COM2:. For a 300- or 2,400-bps modem, substitute 300 or 2400, respectively.

With the COM port set up, you can easily send information to the modem. One possible way is to dial your calls from DOS, in much the same way as you might use the autodialer in *SideKick*. To dial the phone number 123-4567, you would type the DOS command

```
echo ATDT 1234567 > com1: <Enter>
```

The greater-than (>) sign tells DOS to send the text to COM1. *Smartmodem* commands must be typed in all uppercase, but the modem doesn't have any trouble with spaces, parentheses, or hyphens. It interprets a comma as a 1-second pause to wait for an outside line.

If your phone is plugged into the modem, it's probably been switched out of the

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Checking Your Modem's Status
The lights are there to give you a message. Here's what they're telling you.

The most important advantage of an external modem is its bank of seven or eight status lights. They vary from one modem to the next, but the status lights on a Hayes 1200 are typical.

They are:

• **AA (Auto Answer).** This light indicates whether the modem is set to pick up the phone. Not all modems have it. If Auto Answer is on, the modem answers the phone with a screech computers understand and people hate. (Shut off Auto Answer by typing AT S0=0 < Enter >.)

• **CD (Carrier Detect).** This indicates when the modem is talking to another modem. When communications stall, a glance at the CD light indicates if you're still connected.

• **HS (High Speed).** This indicates operation at 1,200 bits per second. When sending a command to your *Smartmodem*, it gives you an immediate check on the speed for which your software is set. When answering a call, the modem automatically matches the speed of the incalling modem; the light indicates if this is 1,200 bps.

• **MR (Modem Ready).** Power-on light, indicating whether the modem is on or off.

• **OH (Off Hook).** OH lights up when the modem connects to the phone line. Some communications programs turn off

the modem speaker when a call is in progress; the light assures you something is happening. When the modem hangs up, the Off Hook light goes out.

• **RD (Receive Data) and SD (Send Data).** These two lights flicker (rather than glow) as information flows in or out of the modem. If the Send Data light doesn't flicker when you type on your keyboard, odds are good that your system has a problem. If it flickers but the other system has stopped echoing (making your RD light flicker), the problem is on the other side.

If the Receive Data light is flickering and there is nothing showing up on your screen, you probably have a problem at your end. But if the light isn't flickering, you know that the other side isn't sending. In most cases, you can deal with a problem on your side by leaving the program and then restarting it; most modems let you do that without breaking the phone connection.

• **TR (Terminal Ready).** This indicates whether the modem thinks the computer is on and ready. One of the lines to the modem (pin 20 on the RS-232 connector) is known as Data Terminal Ready or DTR. If it's off (or "false"), the modem won't answer the phone even when set for auto-answer. *Crosstalk XVI* uses DTR.—**M. David Stone**

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circuit by the dialing command. To get the modem to hang up and resurrect the phone, type

echo ATH > com1: <Enter>

ATH tells the modem, "Attention, hang up."

BATCH DIALING FILES The one-time commands listed above are no faster than dialing yourself. You could hang up by flipping the on-off switch on the modem itself, but electrical circuitry is better left on once turned on.

Better than dialing from DOS is to put all this in a batch file. To create the batch file from the DOS prompt, type

copy con: dial.bat <Enter>

Then enter the body of the batch file:

```
mode com1:1200 <Enter>
echo ATDT %1 %2 %3 %4 %5 > com1:<Enter>
pause <Enter>
echo ATH > com1:<Enter>
<Ctrl-Z> <Enter>
```

Line 1 initializes the COM port. Line 2, the number you dial substitutes for the %1 %2 %3 %4 %5 parameters. You need one parameter for each block of numbers surrounded by a space. The most you'd need would be five if you dialed long-distance, 9 1 (555) 123 4567. Unused parameters are ignored. Line 3 stops the file from going any further and tells you, "Strike a

key when ready . . . ." Once the modem finishes dialing, you pick up the phone, strike a key, and line 4 hangs up the modem. But since you have the phone in your hand, the connection isn't broken. Ctrl-Z <Enter> ends the batch file.

AT, PHONE HOME You can use similar batch files for other purposes. You could create HOME.BAT to call home from work, which requires you to dial 9, pause (the comma pauses 1 second), then dial the number. Create the file as above (or use a word processor), then type

```
mode com1:1200 <Enter>
echo ATDT 9, 123-4567 > com1:<Enter>
pause <Enter>
echo ATH > com1: <Enter>
```

Another useful file to add to your hard disk is NOANSWER.BAT, which tells your modem not to autoanswer the phone. The S0 register sets a Hayes-compatible modem how many times to allow before answering, and a value of 0 is equivalent to never.

```
mode com1:1200 <Enter>
echo AT S0=0 > com1: <Enter>
```

Similarly, HANGUP.BAT hangs up the phone:

```
mode com1:1200 <Enter>
echo AT H > com1: <Enter>
```

These last two files save you from having to load up your communications program all over again if you've left and then noticed the autoanswer or off-hook lights were on.

PUTTING IT ALL TOGETHER Each batch file takes up 2K on your disk (4K if DOS 3.1). Here's a way to put everything on one file called AT.BAT:

```
mode com1:1200 <Enter>
goto %1 <Enter>
:DIAL <Enter>
echo ATDT %2 %3 %4 %5 %6 > com1: <Enter>
pause <Enter>
echo ATH > com1: <Enter>
goto END <Enter>
:HOME <Enter>
mode com1:1200 <Enter>
echo ATDT 123-4567 > com1: <Enter>
pause <Enter>
echo ATH > com1: <Enter>
goto END <Enter>
:NOANSWER <Enter>
mode com1:1200 <Enter>
echo AT S0=0 > com1: <Enter>
goto END <Enter>
:HANGUP <Enter>
mode com1:1200 <Enter>
echo AT H > com1: <Enter>
:END <Enter>
```

To use AT.BAT, you type AT, followed by the desired label—either DIAL,

HOME, NOANSWER, or HANGUP. In the case of DIAL, you simply also type the desired phone number before you hit the Enter key.

The batch file gets to the second line, substitutes the typed label for 1%, then follows the GOTO command to go to that point in the file. In the case of DIAL, it will substitute the phone number for %2 %3 %4 %5 %6. Notice the GOTO END command at the end of each routine, and the END label at the end of the file. This will cause the file to skip over the parts that you don't want to use.

You will probably find that using AT.BAT to its best advantage requires a few refinements.

You may prefer to put the MODE command line in your AUTOEXEC.BAT, the file that DOS looks for and automatically

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runs whenever you boot your system. This will save time when you use AT.BAT, since you won't have to run MODE.COM each time you want to use your modem. If you do this, however, watch out for programs that might reset your COM port in a way that would keep AT.BAT from working. Most communications programs initialize the COM port on their own without a line in AUTOEXEC.BAT, and most leave the COM port set appropriately for AT.BAT.

■ Don't order call waiting on any line with a modem. The call waiting signal sounds to the modem like a lost carrier signal, so the modem hangs up the phone.

CALL WAITING: A NO-NO Finally, here are some practical hints:

Don't order call waiting on any line with a modem. The call waiting signal sounds to the modem like a lost carrier signal, so the modem hangs up the phone and the carrier really is lost.

If you see bursts of random characters—called garbage—caused by noise on the phone line, you may have a bad phone connection. Hang up and place the call again.

Also be aware that one of the surest ways to generate garbage is for someone to pick up a phone while the computer is online. This is always annoying and can be a serious problem if you're in the middle of transferring a file. If you have several extensions in your office, or if your home is infested with typical teenagers, you should consider getting a dedicated line for the modem.

M. David Stone is a frequent contributor to PC Magazine.

■ **PROGRAMMING/UTILITIES** ■ CHARLES PETZOLD

DISKSCAN FINDS BAD SECTORS

Bad sectors are bad news, but heeding the warnings of this messenger can keep your FAT from going into the fire.

Every time you power up your PC, the ROM BIOS performs a thorough check of the memory installed in your system. Whether you like it or not, this check provides a measure of protection against a parity error that could otherwise sabotage your subsequent work.

Unfortunately, the BIOS does not perform a similar check on the hard disks in your system. This means that your hard disk may start developing bad sectors that you would know nothing about until you got the infamous "Abort, Retry, Ignore" message signaling that DOS can no longer read a file.

The DISKSCAN program presented here fills this gap by giving you a way to routinely monitor the health of your hard disk. Very simply, it reads every sector of the disk and reports all the errors it finds. Initially, DISKSCAN reads these sectors in big 64K chunks. (On most disks, this is enough for 128 512-byte sectors.) If the program encounters an error while reading this large group of sectors, it backs up and reads through the same sectors one at a time, reporting which sectors are bad and what types of defects characterize them.

DISKSCAN will work on any disk or other block device that works with CHKDSK. That covers any disk that DOS installs automatically or any disk installed as a device driver in a CONFIG.SYS file. This includes floppy diskettes, hard disks, Bernoulli Boxes, some tape drives, and even RAMdisks.

If it doesn't encounter any bad sectors, DISKSCAN takes about 2½ minutes to check a standard IBM 10-megabyte PC-XT hard disk, and about a minute for a 10-megabyte Bernoulli Box cartridge attached to a PC. Larger disks take longer, of course—not only because of their greater number of sectors, but also because the number of error reports increases. While you might not want to put DISKSCAN in your AUTOEXEC.BAT file, its regular use will alert you to disk problems that may be developing (and the need for backup) before your data disappears.

I'll be discussing how DISKSCAN works and, as usual, we'll explore a few related things together—in this case the organization of a disk and how programs can find out this information from DOS.

DISKSCANNING YOUR HARD DISK To run DISKSCAN you just enter

```
DISKSCAN [drive:]
```

The program will use the default drive if you don't supply the optional parameter.

As it runs, DISKSCAN continuously displays the range of sectors it is reading. Since most disks use sectors that are 512 bytes long, DISKSCAN normally reads in 128 sectors at a time. If it encounters an error, it displays "Error!" for that sector group, skips down a line, and starts reading these sectors one at a time. For each error encountered during this single-sector read, DISKSCAN displays both the number of the bad sector and the error type. I'll get into a discussion of the more common errors later on.

DISKSCAN is on *PC Magazine*'s Interactive Reader Service (IRS), so you can download it after dialing (212) 696-0360 with your modem. If your modem supports the Xmodem protocol, download the executable program DISKSCAN.COM. If you want a copy of the assembly language listing, download DISKSCAN .ASM. (Assemble it with MASM, link it with LINK, ignore the "no stack segment" message, and convert it to the .COM format with EXE2BIN.) If your communications software does not support Xmodem and/or if you don't have the IBM or Microsoft Macro Assembler, you can download DISKSCAN.ASC, rename it to DISKSCAN.BAS, load it into BASICA, and run it. Following this procedure will automatically create the DISKS-CAN.COM executable file.

If you don't have a modem, you can create the DISKSCAN.ASM file with any ASCII text editor by typing in the listing shown in Figure 1. Assemble, link, and convert it to .COM format as described above. Or, you can type in DISKSCAN

> ■ **DISKSCAN will work on any disk or other block device that works with CHKDSK, including any disk installed as a device driver.**

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```
;
;       DISKSCAN.ASM -- Checks out disk by reading sectors
;
CSEG            Segment
                Assume  CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG
                Org     100h
Entry:          Jmp     Begin
;
;       All Data
;
                db      ' Copyright 1986 Ziff-Davis Publishing Co.'
DriveError      db      ' Programmed by Charles Petzold '
DosVereEr       db      'Needs DOS 2.0+$'
MemoryError     db      'Needs 64K$'
DriveNum        db      ?
DiskBlock       db      10 dup (?)
TotalSectors    db      ?
SectorsIn64K    db      ?
StartSector     db      0
SectorLabel     db      9,'Sector $'
SectorLabel2    db      13,'Sector $'
DashLabel       db      ' - $'
ErrorLabel      db      ': Error '
CRLF            db      13,10,'$'
ErrorAddr       db      Err0,Err1,Err2,Err3,Err4,Err5,Err6,Err7
                db      Err8,Err9,ErrA,ErrB,ErrC,ErrD,ErrE,ErrF
Err0            db      'Write Protect$'
Err1            db      'Unknown Unit$'
Err2            db      'Drive Not Ready$'
Err3            db      'Unknown Command$'
Err4            db      'CRC Error$'
Err5            db      'Request Length$'
Err6            db      'Seek Error$'
Err7            db      'Unknown Media$'
Err8            db      'Sector Not Found$'
Err9            db      'No Paper$'
ErrA            db      'Write Fault$'
ErrB            db      'Read Fault$'
ErrC            db      'General Failure$'
ErrD            db      'Undocumented Error$'
BootSectMsg     db      'Boot Sector$'
RootDirMsg      db      'Root Directory$'
BadFatMsg       db      'File Alloc. Table$'
InDosMsg        db      'Used by file$'
NotInUseMsg     db      'Unallocated$'
BadFlagMsg      db      'Flagged as bad$'
FatReadMsg      db      'Can''t Read FAT$'
Divisors        dw      10000, 1000, 100, 10, 1 ; For decimal conversion
;
;       Check Drive Parameter, DOS Version, and Enough Memory
;
;
ErrorExit:      Mov     AH,9            ; Write error message
                Int     21h             ; through DOS
                Int     20h             ; And terminate
;
Begin:          Mov     DX, Offset DriveError  ; Possible message
                Dcr     AL, AL          ; Check Drive Validity Byte
                Jns     ErrorExit       ; If not zero, invalid drive
                Mov     DX, Offset DosVereEr   ; Possible message
                Mov     AH, 30h
                Int     21h             ; Get DOS Version Number
                Cmp     AL, 2           ; Check for 2.0 or later
                Jc      ErrorExit       ; If not, terminate with message
                Mov     DX, Offset MemoryError ; Possible error message
                Mov     BX, 256+Offset EndProg ; Get beyond program
                Mov     SP, BX          ; Move stack closer to code
                Add     BX, 15          ; Add 15 to round up
                Mov     CL, 4           ; Divide BX by 16
                Shr     BX, CL
                Mov     AH, 4Ah         ; Free allocated memory
                Int     21h             ; by calling DOS Set Block
                Jc      ErrorExit       ; Terminate on error
                Mov     BX, 1000h       ; Ask for 64K bytes
                Mov     AH, 48h         ; by using DOS
                Int     21h             ; Allocate Memory Cell
                Jc      ErrorExit       ; Terminate on error
                Mov     ES, AX          ; Save segment of memory block
;
;       Get Disk Information From DOS
;
                Mov     DS, DS:[#05Ch]  ; Get Drive Parameter
                Push    DS              ; Save DS
                Mov     DL, [SI]        ; Cell DOS to
```
(Figure 1 continues)

Figure 1: The assembly language program for DISKSCAN.COM.

.BAS shown in Figure 2 and run it from BASICA to create DISKSCAN.COM.

WARNING If you decide to type in the assembly language listing, be very careful that you do not accidentally change the line that reads

        Int 25h

in the ReadSectors routine to

        Int 26h

It's very bad that a single wrong digit will cause a program to function disastrously, but this is one time that it will. Interrupt 26h is a disk write, and if you inadvertently use that instead of the (correct) Interrupt 25h, your mistake will break in DISKSCAN's writing garbage to your entire disk. You won't even know it until it's too late. I'm not kidding. *Please* double-check that line of code before you try out the program. Better yet, try it out first on a junk diskette to make sure that the program is working OK before you run it on your hard disk.

And because I've just revealed the secret of booby-trapping DISKSCAN, be very wary of any illicit copies you may find floating around on bulletin boards other than *PC Magazine*'s Interactive Reader Service.

READING THE DISK When you program in a high-level language or in assembler, you usually work with files and you really don't care how DOS stores those files on the disk. In fact, the major job of DOS is to organize your files on the disk by manipulating the directory, file allocation table (FAT), and data area so that you don't have to. (It isn't called a *Disk* Operating System for nothing.)

DISKSCAN is one of those rare programs that doesn't work with files—DISKSCAN needs to access the disk sectors directly.

If you've explored the BIOS interrupts in the *DOS Technical Reference* manuals, you may be familiar with the use of Interrupt 13h, which the BIOS provides for directly reading and writing disk sectors. You should stay away from Interrupt 13h, however. Instead, you should take advantage of two other interrupts that DOS provides (25h for reading and 26h for writing)

■ PROGRAMMING/UTILITIES

```
            Int     21h             ; get DOS Disk Block [DS:BX]
            Mov     SI, BX          ; Now DS:SI points to Disk Block
            Mov     DI, Offset DiskBlock ; DI points to destination
            Mov     CX, 18          ; 18 bytes to copy
            Cld                     ; Forward direction
            Rep     Movsb           ; Move 'em in
            Pop     DS              ; Get back DS
            Mov     BX, Offset DiskBlock ; BX to address Disk Block
            Mov     DX, 1           ; Set DX:AX to 65,536
            Sub     AX, AX
            Div     Word Ptr [BX + 2] ; Divide by Bytes Per Sector
            Mov     [SectorsIn48], AX ; Save that values
            Mov     AX, [BX + 13]   ; Last Cluster Number
            Dec     AX              ; AX = Number of Clusters
            Mov     CL, [BX + 5]    ; Cluster to Sector Shift
            Shl     AX, CL          ; Add number of data sectors
            Add     AX, [BX + 11]   ; Add First Data Sector
            Mov     [TotalSectors], AX ; AX = Number Total Sectors
            Mov     AL, DS:[@85Ch]  ; Drive Number (@=al, 1=b)
            Dec     AL              ; Make it 0=A, 1=B
            Mov     GotDriveNumber  ; If no sign, not default drive
            Mov     AH, 19h         ; Get current disk
            Int     21h             ; by calling DOS
GotDriveNumber:
            Mov     [DriveNum], AL  ; Seva Drive Number (@=A, 1=B)

;           Start Reading
; -----------------
MainLoop:   Mov     DX, Offset SectorLabel ; String to display on screen
            Call    StringWrite     ; Display it
            Mov     AX, [StartSector] ; Starting sector number
            Call    WordWrite       ; Display number on screen
            Mov     DX, Offset DashLabel ; String containing a dash
            Call    StringWrite     ; Display it on the screen
            Mov     CX, [SectorsIn48] ; Number of sectors to read
            Add     AX, CX          ; Add it to starting sector
            Dec     AX
            Cmp     AX, [TotalSectors] ; See it bigger than total
            Jbe     NumSectorsOK    ; If so, proceed

NumRecalc:  Mov     AX, [TotalSectors] ; Move total sectors
            Mov     CX, AX          ; Move it to CX also
            Sub     CX, [StartSector] ; Now CX = sectors to read

NumSectorsOK: Mov   AX              ; AX = last sector to read
            Call    WordWrite       ; Display it on screen
            Call    ReadSectors     ; Read the sectors
            Jnc     NextSectors     ; If no error, skip detail
            Call    DiskError       ; Repeat read
            Jnc     NextSectors     ; If still no error, skip

DiskError:  Mov     DX, Offset ErrorLabel ; String saying "Error"
            Call    StringWrite     ; Display it on screen

ErrorLoop:  Push    CX              ; How many previous number
            Mov     CX, 1           ; So we can read one at a time
            Call    ReadSectors     ; Read one sector
            Jnc     NoError         ; If no error, proceed
            Mov     BL, AL          ; Save error code
            Mov     DX, Offset SectorLabel2 ; String with "Sector "
            Call    StringWrite     ; Display it on screen
            Mov     AX, [StartSector] ; The sector we just read
            Call    WordWrite       ; Display it on screen
            Mov     DX, Offset DashLabel ; String with a dash
            Call    StringWrite     ; Display it on screen
            And     BL, @Fh         ; Blank out error lop bits
            Sub     BH, BH          ; Now SX is error code
            Mov     DX, BX          ; Double it for word access
            Mov     DX, [ErrorAddr + BX] ; Get address of message
            Call    StringWrite     ; Display message on screen
            Mov     DX, Offset CRLF ; String for new line
            Call    StringWrite     ; Do carriage ret & line feed

NoError:    Inc     [StartSector]   ; Kick up the start sector
            Pop     CX              ; Get back counter
            Loop    ErrorLoop       ; And read next sector
            Mov     AX, [StartSector] ; Sector of next group
            Jmp     Short CheckFinish ; Check if at end yet

NextSectors: Mov    AX, [StartSector] ; For no error, increment
            Mov     [SectorsIn48], AX ; StartSector for next group
            Jc      Terminate       ; (If overflow, terminate)
            Mov     [StartSector], AX ; And save it
```

(Figure 1 continues)

for accessing disk sectors directly.

The PC-DOS programs CHKDSK, RECOVER, and DEBUG all directly access disk sectors, and all of them use Interrupts 25h and 26h, not Interrupt 13h. (FDISK, FORMAT, SYS, DISKCOPY, and DISKCOMP use Interrupt 13h, but FDISK has to because you use it before DOS even recognizes the disk. FORMAT and DISKCOPY must format a disk, which can only be done through Interrupt 13h.)

The first reason for avoiding Interrupt 13h is that not all disks support it. For instance, many block devices installed in a CONFIG.SYS file (the Bernoulli Box, a RAMdisk, and some tape backup systems are examples) do not use Interrupt 13h at all. Interrupt 13h is really just for IBM disks or imitations of IBM disks.

Interrupts 25h and 26h are also easier to use than Interrupt 13h. To use them you don't need to know the specific construction of the disk (tracks, sectors, cylinders, sides), and you can simply treat the disk as a string of consecutive sectors, starting at sector 0.

A FEW LIMITATIONS The only real disadvantage of using Interrupts 25h and 26h is that they can access only the DOS partition of a hard disk, not the entire disk. Even if your hard disk is partitioned entirely for DOS (as most are), Interrupts 25h and 26h cannot get at the partition table, which is stored on the first sector of the first side of the first cylinder of the hard disk. To Interrupts 25h and 26h, sector 0 is the next physical sector on the disk—namely, the sector that contains the boot record of the DOS partition.

When using Interrupts 25h and 26h in a program, you must also be aware that they mess up the stack somewhat. When DOS returns from these interrupts, it uses the carry flag to signal an error, but your original flags are still on the stack. Thus, your program should pop the flags off the stack or you'll run into problems. While not a big deal in assembly language, this little quirk will prevent you from using any built-in interrupt functions in a compiled language (such as Turbo Pascal's $intr$ or Microsoft's C's $int86$) for Interrupts 25h and 26h. Write an assembly language subroutine instead.

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```
CheckFinish:    Cmp     AX, [TotalSectors]      ; See if at them end
                Jae     Terminate               ; If so, just terminate
                Jmp     MainLoop                ; If not, do it again

Terminate:      Int     20h                     ; Terminates
;
;       Find Sector in FAT to see if used by file, etc.
;
FindSector:     Mov     DX, Offset DashLabel     ; Print dash
                Call    StringWrite
                Mov     DX, Offset WordWithError ; Sector with error
                Mov     DX, Offset BootSectMsg   ; Set up message
                Mov     AX, Word Ptr [DiskBlock + 6] ; See if sector boot
                Jb      PrintMsg                 ; If so, print as such
                Mov     DX, Offset BadFMsg       ; Set up message
                Mov     AX, Word Ptr [DiskBlock + 6] ; See if sector in FAT
                Jb      PrintMsg                 ; If so, print as such
                Mov     DX, Offset RootDirMsg    ; Set up message
                Cmp     AX, Word Ptr [DiskBlock + 11] ; See if sector in dir
                Jb      PrintMsg                 ; If so, print as such
                Push    [StartSector]            ; Save the sector
                Mov     AX, Word Ptr [DiskBlock + 6] ; Reserved sectors
                Mov     [StartSector], AX        ; Start of first FAT
                Mov     CL, [DiskBlock + 15]     ; Sectors for FAT
                Sub     CH, CH                   ; Xoro out top byte
;
                Call    ReadSectors              ; Read in FAT
                Push    [StartSector]            ; Get back sector
                Mov     DX, Offset FatReadMsg    ; Set up possibly msg
                Jc      PrintMsg                 ; If read error, print
                Mov     AX, [StartSector]        ; Get bad sector
                Sub     AX, Word Ptr [DiskBlock + 11] ; Subtract data start
                Mov     CL, [DiskBlock + 5]      ; Sector Shift
                Shr     AX, CL                   ; Shift the sector
                Add     AX, 2                    ; AX is now cluster
                Push    ES                       ; Save ES for awhile
;
                Mov     ES, [ReedSegment]        ; ES segment of FAT
                Cmp     Word Ptr [DiskBlock + 18], #FFFh ; 12 or 16-bit FAT?
                Jb      Fat16bit                 ; And jump accordingly
                Mov     BX, AX                   ; This is cluster number
                Mov     SI, AX                   ; So is this
                Shr     BX, 1                    ; This is one-half cluster
                Mov     AX, ES:[BX + SI]         ; BX + SI = 1.5 CX
                Jnc     NoShift                  ; If no CF from shift, got it
                Mov     CL, 4                    ; If CF from shift most
                Shr     AX, CL                   ; shift word 4 bits right
;
NoShift:        Or      AX, #F000h               ; Now put 1's in top byte
                Cmp     AX, #F000h               ; See if zero otherwise
                Jmp     Short CheckWord          ; And continue checking
;
Fat16bit:       Mov     BX, AX                   ; Cluster number
                Shl     BX, 1                    ; Double it
                Mov     AX, ES:[BX]              ; Pull out word from sector
                Or      AX, AX                   ; See if zero (unallocated)
;
CheckWord:      Pop     ES                       ; Get back ES
                Js      PrintMsg                 ; Set up possible message
                Mov     DX, Offset NotInUseMsg   ; If so, print message
                Jz      PrintMsg                 ; Set up possible message
                Mov     DX, Offset InUseMsg      ; See if cluster flagged bad
                Cmp     AX, #FFF7h               ; If so, print message
                Jz      PrintMsg                 ; If not, cluster is in use
                Mov     DX, Offset InUseMsg
;
PrintMsg:       Call    StringWrite              ; Print cluster disposition
                Ret                              ; And return
;
;       Read Sectors (CX = Number of Sectors, Return CY and AL for error)
;
ReadSectors:    Push    BX                       ; Push all needed registers
                Push    CX
                Push    DX
                Push    DS
                Mov     AL, [DriveNum]           ; Get the drive number code
                Sub     AX, AX                   ; Buffer address offset
                Mov     DX, [StartSector]        ; Starting sector
                Mov     DS, [ReedSegment]        ; Buffer address segment
                Int     25h                      ; Absolute Disk Read
                Pop     AX                       ; Fix up stack
                Pop     DS                       ; Get back registers
                Pop     DX
                Pop     CX
                Pop     BX
                Ret                              ; Return to program

                                                (Figure 1 continues)
```

DISK ORGANIZATION As you may know from the DOS *Technical Reference* manuals or from reading Peter Norton's books and columns, a disk is divided into four separate areas: the boot sector (usually just the first sector), the file allocation tables (generally a disk maintains two identical copies), the directory, and the data.

Under DOS 1.1, it was pretty easy to determine the number of sectors used for each of these areas of the disk. The layout of the two supported disk formats (double-sided and single-sided) were fixed. But if you've ever looked around with FDISKing a hard disk into several partitions or used VDISK 3.x, you'll see that DOS 2.0 and above can support an almost infinite variety of disk formats.

For DISKSCAN to scan through all the sectors of a hard disk, it must know the total number of sectors on the disk or (in the case of hard disks) in the DOS partition. This is not a trivial problem, for the information is simply not readily available from the documented DOS function calls. The closest you can come is with DOS Interrupt 21h Function Calls 1Bh, 1Ch, and 36h. These return CX equal to the number of bytes per sector, DX equal to the number of clusters, and (for 36h only) BX equal to the number of free clusters. But the clusters (which comprise one or more sectors) only pertain to data. These function calls do not tell you the number of sectors used by the FAT or the directory.

Instead, you have to use DOS Interrupt 21h Function Call 32h to calculate the total number of sectors on the disk. DOS maintains a "DOS Disk Block" (the terminology is mine) for every disk on your system. This DOS Disk Block describes the layout of the disk. Function Call 32h allows you to look at it. Since IBM evidently forgot to document the DOS Disk Block and Function Call 32h in its DOS *Technical Reference* manuals, I've presented a description of them in Figure 3.

To complete the picture drawn in Figure 3, the related Function Call 1Fh returns the same information as 32h, but for the default drive. (This function call even works with DOS 1.1, although the information is slightly different.) As you'll notice from Figure 3, each DOS Disk Block contains a double-word address that points to the next one. The DOS Disk Blocks are

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```
;       Screen Display Routines
;       ------------------------

WordWrite:      Push    AX                      ; Push some registers
                Push    BX                      ; AX contains word to display
                Push    CX
                Push    DX
                Push    SI
                Mov     SI, Offset Divisors     ; SI points to divisors
                Mov     CX, 4                   ; CL counter; CH zero blanker

WordWriteLoop:  Mov     BX, [SI]                ; Get divisor
                Add     SI, 2                   ; Increment SI for next one
                Sub     DX, DX                  ; Prepare for division
                Div     BX                      ; Divide DX:AX by BX
                Push    DX                      ; Save remainder
                Or      CH, AL                  ; See if zero
                Js      LeadZero                ; If no, do not display it
                Add     AL, '0'                 ; Convert number to ASCII
                Mov     DL, AL                  ; Print out character
                Int     21h                     ; by calling DOS

LeadZero:       Pop     AX                      ; Get back remainder
                Dec     CL                      ; Decrement counter
                Jnz     WordWriteLoop           ; If CL still > 0, do it again
                Mov     CH, 1                   ; No more zero blanking
                Jz      WordWriteLoop           ; Convert last digit to ASCII
                Pop     SI
                Pop     DX
                Pop     CX
                Pop     BX
                Pop     AX
                Ret

StringWrite:    Pop     AX
                Mov     AH, 9                   ; Displays string from DX
                Int     21h                     ; to screen by calling DOS
                Push    AX
                Ret

EndProg         Label   Byte                    ; End of program
CSEG            EndS
                End     Entry
```

(Figure 1 ends)

```
100  REM -- BASIC PROGRAM TO CREATE diskscan.COM
110  OPEN "diskscan.COM" AS #1 LEN = 1
120  FIELD #1,1 AS A$
130  CHECKSUM = 0
140  FOR I% = 1 TO 126
150     LINESUM% = 0
160     FOR J% = 1 TO 8
170        READ BYTE%
180        CHECKSUM = CHECKSUM + BYTE%
190        LINESUM% = LINESUM% + BYTE%
200        IF (BYTE% < 256) THEN LSET A$ = CHR$(BYTE%)
210        PUT #1
220     NEXT J%
230     READ LINECHECK%
240     IF LINECHECK% <> LINESUM% THEN PRINT "Error in Line";200 + 10 * I%
250  NEXT I%
260  CLOSE
270  IF CHECKSUM = 93163 THEN PRINT "Successful Completion": END
280  PRINT "COM file is not valid!": END
290  DATA  233,    1,    2,   32,   67,  111,  112,  121,  679
300  DATA  114,  105,  183,  104,  116,   32,   49,   57,  680
310  DATA   56,   54,   32,   98,  105,  103,  182,   45,  586
320  DATA   68,   97,  118,  105,  115,   32,   88,  117,  732
330  DATA   58,   58,  185,  115,  184,  185,  118,  183,  848
340  DATA   32,   67,  111,   46,   32,   88,  114,  111,  593
350  DATA  183,  114,   97,  185,  109,  115,  104,   32,  765
360  DATA   98,  121,   32,   67,  104,   97,  114,  108,  741
370  DATA  105,  101,   32,   80,  101,  110,  116,  111,  778
380  DATA  110,   32,   73,  118,  118,  118,   97,  108,  746
390  DATA  185,  108,   32,   68,  114,  185,  118,  101,  742
400  DATA  185,  108,  181,  181,  108,  115,   52,   68,  636
410  DATA  209,   79,   83,   32,   58,   46,   48,   43,   36,  417
420  DATA  228,   78,  181,  181,  184,  115,   32,   54,   52,  633
430  DATA   75,   36,    0,    0,    0,    0,    0,    0,  111
440  DATA    0,    0,    0,    0,    0,    0,    0,    0,    0
450  DATA    0,    0,    0,    0,    0,    0,    0,    0,    0
460  DATA    0,    0,    0,    0,    0,    0,   23,  181,  193
```

Figure 2: A BASIC program that will create DISKSCAN.COM.

(Figure 2 continues)

thus organized in a chain within DOS. The chain begins with drive A: and continues alphabetically for every disk (or other block device) in your system. Function Call 52h returns ES:BX pointing to a double word that begins the chain; that is, the double word stored at ES:BX is the address of the DOS Disk Block for drive A:. You should know, too, that Function Calls 1Fh and 32h cause a disk access to occur to check if the medium has been changed. Function Call 52h alone does not cause a disk access, so the information it returns may be incorrect if you've changed a disk since you were last accessing it.

DOS calculates the information in the DOS Disk Block by first making a BIOS Parameter Block call to the device driver. (The BIOS Parameter Block is well documented in the DOS *Technical Reference* manuals, so I won't repeat the information here.) You'll notice that the DOS Disk Block contains the address of the device driver header. With this address, a program could even make calls directly to the device driver, including a BIOS Parameter Block call. You may also be interested in DOS Function Call 53h, which translates the information in the format of the BIOS Parameter Block table (pointed to by DS:SI) to the format of the DOS Disk Block table (pointed to by ES:BP).

DISKSCAN only needs a few pieces of information from the DOS Disk Block. Specifically, it needs the number of clusters used for data, the number of sectors per cluster, the sector number where data begins, and the number of bytes per sector. (Most often a disk will use 512 bytes per sector, but RAMdisks may use less and disks larger than 32 megs will use more.) Other programs (such as CHKDSK or some of *The Norton Utilities*) generally require a lot more information from the DOS Disk Block.

Whenever you need to directly access disk sectors in the directory or FAT, don't make any assumptions about where these sectors are located. Use Function Call 32h to get the information. That's what it's there for.

TRY AND TRY AGAIN When a program makes DOS function calls to access files, DOS calls the device driver to read and write the appropriate sectors. The de-

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```
470 DATA 99, 116, 111, 114, 32, 36, 13, 83, 604
480 DATA 101, 99, 116, 111, 114, 115, 32, 36, 724
490 DATA 32, 45, 32, 36, 50, 32, 69, 114, 410
500 DATA 114, 111, 114, 33, 13, 10, 36, 247, 638
510 DATA 1, 221, 1, 234, 1, 258, 1, 10, 719
520 DATA 2, 20, 2, 35, 1, 221, 2, 86, 485
530 DATA 2, 77, 2, 86, 2, 98, 2, 109, 489
540 DATA 2, 125, 2, 125, 2, 125, 2, 478, 857
550 DATA 114, 116, 101, 99, 116, 111, 114, 133, 773
560 DATA 116, 116, 101, 101, 99, 116, 111, 114, 776
570 DATA 118, 111, 119, 118, 111, 32, 85, 105, 785
580 DATA 99, 98, 101, 116, 110, 36, 118, 118, 786
590 DATA 98, 108, 111, 99, 118, 32, 66, 101, 711
600 DATA 78, 111, 116, 32, 82, 101, 97, 100, 717
610 DATA 118, 32, 67, 111, 109, 109, 97, 110, 753
620 DATA 108, 36, 98, 67, 67, 63, 32, 69, 540
630 DATA 114, 111, 114, 33, 13, 10, 36, 247, 658
640 DATA 114, 111, 114, 33, 13, 10, 36, 247, 658
650 DATA 116, 104, 36, 83, 101, 101, 107, 32, 689
660 DATA 69, 114, 114, 111, 114, 32, 36, 36, 626
670 DATA 67, 111, 110, 118, 32, 77, 101, 100, 761
680 DATA 108, 105, 97, 32, 36, 36, 32, 36, 382
690 DATA 114, 114, 32, 78, 111, 116, 32, 82, 789
700 DATA 101, 97, 100, 121, 33, 13, 10, 36, 511
710 DATA 118, 98, 97, 112, 101, 118, 32, 36, 634
720 DATA 105, 116, 101, 32, 70, 97, 105, 108, 724
730 DATA 114, 116, 36, 83, 101, 99, 116, 111, 654
740 DATA 114, 32, 36, 36, 36, 36, 73, 110, 523
750 DATA 101, 114, 32, 36, 32, 36, 118, 105, 564
760 DATA 118, 108, 36, 83, 99, 116, 111, 114, 727
770 DATA 114, 111, 114, 33, 13, 10, 36, 247, 658
780 DATA 118, 108, 36, 32, 69, 114, 114, 111, 584
790 DATA 66, 111, 111, 116, 32, 82, 101, 97, 716
800 DATA 100, 32, 69, 114, 114, 111, 114, 33, 700
810 DATA 32, 36, 105, 105, 114, 32, 36, 36, 386
820 DATA 65, 108, 108, 36, 83, 101, 99, 116, 720
830 DATA 116, 101, 36, 83, 101, 99, 116, 111, 730
840 DATA 97, 108, 36, 32, 66, 97, 100, 32, 538
850 DATA 101, 101, 116, 36, 73, 110, 73, 116, 685
860 DATA 101, 36, 36, 116, 111, 118, 101, 115, 654
870 DATA 97, 103, 101, 32, 32, 101, 114, 114, 624
880 DATA 97, 32, 36, 36, 13, 10, 36, 247, 512
890 DATA 32, 36, 36, 116, 111, 118, 101, 36, 602
900 DATA 118, 101, 36, 36, 32, 36, 108, 0, 347
910 DATA 108, 108, 36, 36, 32, 36, 108, 0, 456
920 DATA 104, 108, 8, 8, 8, 8, 108, 0, 252
930 DATA 205, 33, 205, 32, 106, 75, 1, 10, 747
940 DATA 192, 117, 243, 106, 89, 1, 100, 48, 936
950 DATA 33, 60, 48, 32, 114, 232, 106, 36, 651
960 DATA 1, 107, 237, 5, 139, 227, 131, 195, 1032
970 DATA 15, 177, 4, 211, 235, 108, 74, 16, 1181
980 DATA 233, 114, 211, 107, 8, 16, 100, 72, 821
990 DATA 205, 33, 114, 202, 161, 114, 1, 130, 970
1000 DATA 22, 92, 0, 38, 108, 50, 205, 33, 612
1010 DATA 139, 243, 191, 117, 1, 185, 10, 8, 894
1020 DATA 252, 243, 164, 31, 107, 117, 1, 186, 1181
1030 DATA 1, 8, 43, 192, 247, 119, 2, 163, 767
1040 DATA 137, 1, 233, 71, 13, 72, 138, 79, 658
1050 DATA 5, 211, 224, 5, 71, 11, 163, 135, 823
1060 DATA 1, 160, 92, 8, 204, 208, 121, 4, 832
1070 DATA 12, 205, 33, 162, 247, 119, 2, 166, 942
1080 DATA 1, 232, 16, 1, 161, 139, 1, 784, 0 (unclear)
1090 DATA 232, 51, 1, 106, 160, 1, 232, 93, 956
1100 DATA 1, 139, 14, 137, 1, 3, 193, 114, 602
1110 DATA 6, 59, 6, 135, 1, 118, 9, 551
1120 DATA 135, 1, 139, 208, 43, 14, 139, 1, 1083
1130 DATA 75, 232, 241, 0, 115, 78, 106, 144, 1083
1140 DATA 65, 1, 232, 241, 0, 115, 70, 106, 1006
1150 DATA 128, 1, 232, 228, 0, 115, 62, 169, 789
1160 DATA 1, 232, 33, 33, 1, 161, 139, 1, 691
1170 DATA 106, 1, 232, 215, 0, 186, 168, 1, 909
1180 DATA 1, 128, 227, 15, 42, 255, 3, 219, 919
1190 DATA 139, 151, 175, 1, 232, 7, 1, 232, 938
1200 DATA 19, 1, 139, 14, 135, 1, 232, 0, 541
1210 DATA 0, 41, 8, 106, 172, 1, 232, 72, 632
1220 DATA 255, 6, 139, 3, 89, 226, 197, 161, 1074
1230 DATA 139, 1, 232, 13, 161, 139, 1, 691
1240 DATA 6, 137, 1, 114, 13, 161, 13, 573
1250 DATA 0, 135, 6, 135, 1, 115, 3, 233, 618
1260 DATA 226, 0, 37, 0, 186, 160, 1, 232, 842
1270 DATA 0, 161, 139, 1, 186, 144, 1, 232, 864
1280 DATA 206, 6, 133, 1, 114, 186, 156, 770
1290 DATA 129, 0, 133, 1, 114, 125, 186, 156, 944
1300 DATA 59, 0, 128, 1, 114, 186, 255, 1089
1310 DATA 54, 139, 1, 161, 123, 1, 163, 701
1320 DATA 1, 138, 14, 132, 1, 2, 232, 797
```

vice driver then uses Interrupt 13h (in the case of an IBM or compatible hard disk or diskette), or goes directly to the I/O ports of the device (in the case of a Bernoulli Box), or just accesses memory (in the case of a RAMdisk).

If the device driver cannot carry out the request because of a problem with the disk, DOS tries calling the device driver again. This sometimes works and sometimes does not. If after three successive tries the device driver still returns an error, DOS displays its Critical Error "Abort, Retry, Ignore" message.

Interrupts 25h and 26h, however, make only one direct call to the device driver. On an error, these interrupts return an error code instead of initiating the "Abort, Retry, Ignore" message. If you get an "Abort, Retry, Ignore" message from DISK-SCAN, it can only come from one place—the Function Call 32h. This means that the device driver cannot even determine the media in the drive. For a diskette, that could mean that the door is open or the disk is unformatted. For a hard disk that has been FDISKed and FORMATted, getting a Critical Error from Function Call 32h indicates a serious problem.

Although Interrupts 25h and 26h go out to the device driver only once and do not retry, you may notice sometimes (particularly when using DISKSCAN on a diskette) that something is accessing the disk five times before DISKSCAN reports the error. This is actually the device driver itself performing some retries. IBM has optimized the speed of the device drivers by having them set the track seek time to 0 before accessing the disk. This is likely to cause more misreads, so the device driver itself tries five times before giving up and returning an error.

TRACKING DOWN BAD SECTORS

When you first formatted your hard disk, you may have noticed that the FORMAT command indicated that the disk had some bad sectors (most do). When you run CHKDSK, you may also see a line telling you that some bytes of the disk are in bad sectors. Moreover, while CHKDSK may indicate that your PC-XT hard disk has, for instance, 4096 bytes in bad sectors, DISKSCAN may tell you that only one 512-byte sector is bad. This is because the

■ PROGRAMMING/UTILITIES

```
1330 DATA    91,    8,  143,    6,  139,    1,  106,  229,  795
1340 DATA     2,  116,   70,  161,  139,    1,   43,    6,  544
1350 DATA   139,    2,  136,   14,  122,    1,  211,  232,  847
1360 DATA     5,    2,    8,    6,  142,    6,  114,    1,  276
1370 DATA   139,   62,  136,    1,  248,   15,  125,   23,  735
1380 DATA   139,  216,  139,  248,  209,  235,   30,  139, 1355
1390 DATA     8,  115,    4,  177,    4,  211,  232,   13,  756
1400 DATA     8,  248,   61,    8,  248,  235,    9,  139,  924
1410 DATA   216,  209,  227,   38,  139,    7,   11,  192, 1039
1420 DATA     7,  106,  212,    6,  116,   11,  106,  214,  924
1430 DATA     2,   61,  247,  255,  116,    5,  196,  186, 1059
1440 DATA     2,  232,   74,    8,  195,   83,   81,   82,  749
1450 DATA    38,  160,  116,    1,   43,  219,  139,   22,  738
1460 DATA   139,    1,  142,   38,  114,    1,  205,   37,  669
1470 DATA    91,   31,   90,   89,   91,  195,   88,   83,  750
1480 DATA    81,   82,   86,  198,  244,    2,  185,    4,  874
1490 DATA     8,  139,   28,  131,  190,    2,   43,  210,  751
1500 DATA   247,  243,   82,   18,  232,  116,    8,    6,  942
1510 DATA   196,   48,  138,  208,  140,   23,   33,   89,  902
1520 DATA   254,  201,  127,  229,  101,    1,  116,  225, 1334
1530 DATA    94,   98,   89,   91,   88,  195,    8,   88,  743
1540 DATA     9,  205,   33,   88,  195,    8,    8,    9,  530
```

(Figure 2 ends)

file allocation table works with clusters. If any sector of a cluster is bad, the whole cluster must be marked.

Fortunately, when the FORMAT command encounters bad sectors, it places an indicator in the file allocation table so these sectors cannot be used for data. DISK-SCAN cross-references the bad sectors it finds against the list DOS put into the file allocation table at format time and returns the reassuring report, "Flagged as bad,"

when appropriate.

The best thing to do, then, is to run DISKSCAN soon after you format a hard disk and print out the list of bad sectors it encounters. Then, when you later run DISKSCAN, check the new list against the old. (Since paper lists have a way of getting lost, it makes sense to use the DOS redirect facility to create a file of known bad sectors against which subsequent DISKSCAN outputs can be compared.)

Figure 3: *The undocumented DOS Interrupt 21h Function Call 32h is useful for obtaining information about the structure of a disk.*

```
DOS Int 21h Function Call 32h -- Get "DOS Disk Block"

On Entry    Register Contents

AH          32h
DL          Number of Disk Drive (0=default, 1=A, etc.)

On Return   Register Contents

AL          = 0ff if drive exists, 0ffh for invalid drive
DS:BX       Pointer to DOS Disk Block

Description

The DOS Disk Block contains the following information at
the indicated offsets of DS:BX

Offset    Size     Data

00        Byte     Drive; 0=A, 1=B, etc.
01        Byte     Unit with driver (0, 1, 2, etc.)
02        Word     Bytes per sector
04        Byte     Sectors per cluster - 1
05        Byte     Cluster to sector shift
06        Word     Number of reserved (boot) sectors
08        Byte     Number of File Allocation Tables
09        Word     Number of root directory entries
0B        Word     Sector number of cluster 2
                   (cluster 2 is first data cluster)
0D        Word     Number of clusters + 1
                   (or last cluster number)
0F        Byte     Sectors for FAT
10        Word     Sector number of directory
12        DWord    Address of device header
16        Byte     Media Descriptor byte
17        Byte     Zero if disk has been accessed
18        DWord    Address of next DOS Disk Block
                   (FFFF if last one in chain)
```

COMMON ERROR MESSAGES

Although DISKSCAN has error messages for the 13 different types of errors it can find, some of them (like "Write Protect" and "No Paper") are obviously inapplicable. The error types you'll most commonly see will be:

CRC Error: When information is stored on a disk, a check-sum value (otherwise known as the Cyclic Redundancy Check) is also stored on the disk. If this value does not agree with a recalculated value when the data is read, then the assumption is made that the data is invalid, and you'll get this message.

Sector Not Found: This indicates that the boundaries that FORMAT created to mark the sectors have been destroyed and the sector being read is no longer clearly marked on the track. You may get several of these messages in a row.

Read Fault and General Failure: These are generalized errors that don't fall into the other categories.

DISKSCAN's second set of messages will probably be of greater help to you in tracking down the trouble:

File Alloc. Table and Can't Read FAT: These point to a very serious situation. Stop whatever you're doing and back up everything you can, using the DOS COPY command, then reformat your hard disk before you restore your backed up files.

Boot Sector: This is a little easier, since you could always reboot your machine from the drive A: floppy. Put your DOS disk in A: and execute the command SYS C:, followed by COPY COMMAND.COM C: to replace the boot-up files on your hard disk with fresh copies, and see if this isn't enough.

Root Directory: Errors here could keep you from later being able to load a file or save updates to it. If you run CHKDSK, you will probably get messages referring to unallocated cluster chains or cross-linked files. You may have to run CHKDSK/F to fix these. *[See also the PC Lab Notes column entitled "Eradicating Erasure Errors," in PC Magazine, Volume 5 Number 7—Ed.]*

Unallocated: A disk error in an unallocated sector of the disk is not yet serious since that sector is not currently being used by any file. On the other hand, when a file eventually gets written to that area, you'll

■ PROGRAMMING/UTILITIES

get an "Abort, Retry, Ignore." When that happens, select "Ignore," rename the file just saved to something else, save your file again, then use RECOVER on the first file. This way DOS will flag the bad clusters and not try to use them later. Then delete the first file, keeping the second version you saved.

Used by file: Which files—and what can be saved from them—are the questions when you get this message.

Unfortunately, to expand the already long DISKSCAN code to pinpoint just which files contain these bad sectors is not feasible in this column. DISKSCAN would have to start accessing directory and subdirectory entries, find the cluster where each file began, and then look in the file allocation table for the chain of clusters until it happened upon the same one. Still, there are things that can be done.

One possible way to track down the files that contain bad sectors is to use my SWEEP program (*PC Magazine*, Volume 4 Number 23), which executes a command over all subdirectories on your hard disk. You would start at your root directory and enter the command

SWEEP COPY *.* NUL

Whenever COPY tries to read a file with a bad sector, you'll get an "Abort, Retry, Ignore" message. Write down the name of the file (the one that appears above the message), press "I", and continue.

USING RECOVER A file with a bad

sector right in the middle of it can present problems to programs that use the file. The first thing you'll want to try to do is copy it to another file with a different name, using "R" when DOS asks you to "Abort, Retry, Ignore." If that doesn't work, you have the opportunity of using one of the most neglected of all the PC-DOS commands. This command is called RECOVER. To use it enter

RECOVER filename

where "filename" is the name containing the bad sector. RECOVER will do two things: First, it will mark the bad sector or sectors (more precisely, it marks the clusters that contain these bad sectors) as bad in the file allocation table, so they cannot be used again. Second, RECOVER patch-

es the file together so that those bad sectors are skipped.

(Do not use RECOVER without the filename parameter, however: it performs quite differently and will not do what you want it to.)

Will the RECOVERed file be usable? That depends. If it's a .COM or .EXE program, then it will probably crash if you try to run it because it's missing a piece. If it's a worksheet file or database file, your spreadsheet or database program will probably choke on it. If it's a word pro-

■ **If you regularly back up your hard disk and run DISKSCAN, you'll have some insurance against catastrophe and reassurance about the health of your data.**

cessing file or a program source listing, however, you may be in luck. It will be missing something, but a good deal of it may still be there, and you may be able to reconstruct the rest.

THE EARLY WARNING Recovery of a

disk or data that has developed bad sectors is an art in itself. If you can, you want to avoid the process entirely.

Thus DISKSCAN's most useful function is to give you an early warning that your hard disk is showing signs of decay. If you regularly back up your hard disk and run DISKSCAN, you'll at least have some insurance against catastrophe and reassurance about the health of your data. If DISKSCAN starts to show more and more bad sectors every time you run it, probably the best thing you can do is dig out your warranty and start reading it. ▣

Charles Petzold is a contributing editor of PC Magazine and the editor of the PC Tutor column.

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■ EDITED BY JARED TAYLOR

SPREADSHEET CLINIC

This forum lets readers exchange the ingenious solutions and timesaving hints that make their spreadsheets and integrated software packages work better.

COLOR ADJUSTMENTS IN SYMPHONY 1.1 AND 1-2-3 2.0

Now that Lotus has released new versions of both *Symphony* and *1-2-3*, it's time to adjust the colors to something more pleasing. The procedure, using DEBUG.COM, is very much like the one outlined in your column of July 9, 1985 (Volume 4 Number 14).

For both programs, the colors on the screen are controlled by the device drivers, which are in special files: LOTUS.SET for *Symphony* and 123.SET for *1-2-3*. If you have alternative configurations stored in .SET files with different names, you can change the colors in them, too. Each color is a single hexadecimal digit, and two colors are stored at each program address. The following instructions are for modifying *Symphony* 1.1's colors, but the procedure for *1-2-3*, Version 2.0, is exactly the same. Just substitute the name of the proper .SET file. Note that every occurrence of 0 is a zero, not a capital letter O.

First, make a backup copy of your current LOTUS.SET file in case you do something awful to it. Next, put the *Symphony* program disk in drive A: and a disk with DEBUG.COM on it in drive B:. At the A> prompt, type

b:DEBUG lotus.set<Enter>

At DEBUG's prompt, type

s 100 aaaa 07 30 0a 3f<enter>

This is a search operation to locate the address at which the default color values, 07 30 0a 3f, appear. DEBUG will now re-

spond with the address—something like 0AD6:19ED. (Different LOTUS.SET files will produce different addresses because they are configured for different systems.) To display the values at that address, type

d XXXX:XXXX<Enter>

using the address DEBUG gave you in place of the XXXX's. To change the values for the color settings, type

e XXXX:XXXX<Enter>

DEBUG will respond with 07, which is the first color value. Type two new digits and hit the space bar. DEBUG will then give you the second pair of numbers, 30, and you type two new digits. Hit the space bar and keep going until you have typed new numbers for all four pairs. Then hit Enter. When you get the - prompt again, type

w<Enter>

■ Now that Lotus has released new versions of both *Symphony* and *1-2-3*, it's time to adjust the colors to something more pleasing.

DEBUG will tell you how many bytes it is writing. At the - prompt, type

q<Enter>

This takes you out of DEBUG and back to the A> prompt.

I like to leave the first and third pairs of numbers as they are (just hit the space bar without typing new values) and change the second to 1B and the fourth to 20. This changes the background colors as well as the color of the cursor when it is in a protected range. Have fun experimenting with different color combinations. Here is a chart of which colors the different hexadecimal digits stand for:

0—black	8—gray
1—blue	9—dark blue
2—green	A—bright green
3—light blue	B—bright blue
4—red	C—bright red
5—purple	D—bright purple
6—brown	E—yellow
7—white	F—bright white

Bill Vera
Windsor, Connecticut

1-2-3/EPSON PRINTER CODES

Your readers might find it useful to have a list of *1-2-3* printer setup codes that will work with Epson FX, Epson MX, and IBM Graphics printers. They are shown in Figure 1.

By combining codes, up to a maximum of 39 characters, you can get just about any effect the printer is capable of producing. For example,

\027\0671\0274\027\071\027\069

■ SPREADSHEET CLINIC

will give you double-width, double-strike, emphasized italic.

John Moody
Portsmouth, Virginia

Elite characters and proportional spacing aren't available on older Epson printers, but the other codes are common to them all. For other useful printer setup strings, see the next item.

DOUBLE-SPACED PRINTING

In Spreadsheet Clinic (Volume 4 Number 24), you included an item on printing *1-2-3* spreadsheets double spaced. A better way to do this is to use a printer setup string to change your printer spacing. The codes vary from printer to printer, but for Epson MX, Epson FX, and IBM Graphics printers, the string \027A\024 initiates double-spaced printing.

If you use this technique, it's also a good idea to reset the page length in *1-2-3* to 33 instead of 66 if you want to number the pages or include headers or footers. This is because *1-2-3* counts each double-spaced line as one line only and doesn't realize it's using twice as much paper.

John Sobotincic
Eric, Pennsylvania

The string \027A\xxx lets you vary the line spacing in increments of $^1/_{72}$ inch, where xxx is the number of seventy-seconds, from 001 to 085. In Mr. Sobotincic's example, $^{24}/_{72}$ is $^1/_3$, which gives you three lines per inch instead of the usual six. \027A\012, or $^{12}/_{72} = ^1/_6$, would be the default spacing of six lines per inch. For even finer tuning, you can vary line spacing in increments of $^1/_{216}$ of an inch by using the string \0273\xxx, where xxx can be any integer from 001 to 255.

I find it annoying when just a few lines of a spreadsheet spill over onto a second page. By tweaking the line spacing and page length, you can often keep the whole thing on a single page, and the line compression will hardly be detectable.

CONCATENATING CELL ENTRIES

Have you ever had to take labels from several *1-2-3* cells and join them together in a single cell? If you have, you know how boring a typing job that can be. The macro

in Figure 2 will do the work for you. To understand its operation, suppose you want to take labels from cells B24, B25, and B26 and put them together in cell C50. Run the macro by typing Alt-C<Enter>. It will successively prompt you for the addresses of the input cells. Enter the addresses B24, B25, and B26. When you have entered addresses for all the cells you want concatenated, answer the prompt with a number instead of a cell address. This tells the macro that you have finished with the input cells, and it will prompt you for the address of the cell where you want to put the concatenated output. Enter C50. The macro will go to that cell and write in the contents of the first three cells.

The labels in the first column of Figure 2 are, of course, range names, which must be given to the cell to their right. INADD and OUTADD are deliberately left blank and will be filled in by the macro. The address H4 in the first and next-to-last lines can be any address that gives you a blank column to use as a work space.

This macro concatenates numbers as well as labels, and you can automate it to

repeat the operation on a range of labels. Concatenation can be especially useful when you have stored names and addresses in separate cells but want to join them for printing address labels.

W. J. Jhang
Cerritos, California

The real brains in this macro are in the first line and the last two. The first line, which sets out the work space, writes an apostrophe (') at the top of the column. The rest of the macro then prompts you for cell addresses and stores their contents in individual cells below the apostrophe. The next-to-last line copies the contents of END ($^{\land}$1xq) to the bottom of the storage column, sends control to the top of the column, and treats it like a continuation of the macro. Since there is an apostrophe at the top of the column, the macro types the whole column into the destination cell and enters it with the tilde ($^{\land}$) that came from the cell named END. As you will see if you run the macro, you need that 1xq, but it could be an 1xg instead if you want the macro to go on to do something else.

Figure 1 1-2-3 setup codes for Epson MX, Epson FX, and IBM Graphics printers.

```
NO CODE    Standard characters (10 per inch, 6 lines per inch)
\015       Double-width to end of line (\024 cancels)
\015       Compressed characters, 17.1 per inch (\018 cancels)
\027\064   Master reset code, printer returned to power-up state
\027\069   Emphasized type (\027\070 cancels)
\027\071   Double-strike (\027\072 cancels)
\027\077   Elite type, 12 per inch (\027\080 cancels)
\027E      8 lines per inch (\027\050 cancels)
\027I      Line spacing of 7/72" (\027\072 cancels)
\0273      16.5 lines per inch (\027\072 cancels)
\0274      Italics (\0275 cancels)
\027\0451  All characters underlined (\027\0450 cancels)
\027\0830  Superscript (\027\0840 cancels)
\027\0831  Subscript (\027\0840 cancels)
\027\0871  Double-width (\027\0870 cancels)
\027\1121  Proportional spacing (\027\1120 cancels)
```



```
\C        /rncINELABEL~H4~{goto}INADD~
          /xlAddress of first input ?"INADD~/xgNEXT~
LOOP      /xlNext Addr? {AnyMoreOrNumberIfNoMore}~INADD~
NEXT      {goto}INELABEL~{down}/rncINELABEL~be}~
          {goto}INADD~{down}{home}{del}~
          /xiINADD>8~/xgLAST~
          /c
INADD     ~INELABEL~/xiIN&ABEL>8~/xgLABEL~
NUMBER    {goto}INELABEL~{edit}{home}{end}~/xgLOOP~
LABEL     {goto}INELABEL~{edit}~/xgLOOP~
LAST      /xlWhere do you want the output ?"OUTADD~{goto}
OUTADD
          /cENID~INELABEL~/xgH4~
END
```

Figure 2 A 1-2-3 macro that concatenates the cells you specify.

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■ SPREADSHEET CLINIC

WORD PROCESSING IN COLUMNS

As a script writer by profession, I did not expect to use my spreadsheet program for much more than keeping simple business accounts. However, I have found it more useful to me than the word processing programs I own.

The reason for this is that TV and video scripts are written in two columns, with visuals described on the left and accompanying narration on the right. To produce such a parallel format with most word processors requires using bothersome tabs and format controls, and rewriting is a real headache. While there are special script-processing programs that format text in parallel columns, none of them gives you on-screen formatting. *[A few, including XyWrite III, do—Ed.]*

My solution is to use a spreadsheet. By defining columns of specific dimensions as text cells, I can see exactly what the

■ While there are special script-processing programs that format text in columns, only a few of them give you on-screen formatting.

printed page will look like. With three columns set to widths of 38, 4, and 38 characters, I can type two columns with a four-character gutter between them. A spreadsheet's column orientation and basic text-editing functions also let you cre-

ate interesting layouts for newsletters.

Gerald Cooper
Mount Holly, New Jersey

This is a good tip for all spreadsheet users, no matter which program they own. 1-2-3 users can combine these ideas with the word processing macros suggested by J. David Highland in the March 11, 1986, Spreadsheet Clinic (PC Magazine, Volume 5 Number 5).

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■ EDITED BY CRAIG L. STARK

POWER USER

Push your hardware and applications software to the limit by incorporating these productivity-enhancing tips from readers

EPSON MODE CHANGING

Switching between draft and near-letter-quality (NLQ) modes on the new Epson LQ-1500 printer is cumbersome at best. One way is to go to the back panel of the printer and change the DIP switch settings, which is a nuisance. The print mode can also be changed through software, but even that method can be awkward without the right tools.

To simplify the change I wrote a short .COM program to switch from draft to NLQ mode. You can create it for your own use with the DOS DEBUG program. After starting DEBUG from the DOS A> prompt, you will see a minus sign prompt (−). Issue an a (for assemble) command, and DEBUG's miniassembler will start your .COM program correctly at offset

```
A>debug
-a
xxxx:0100 mov dl,1b
xxxx:0102 mov ah,#5
xxxx:0104 int 21
xxxx:0106 mov dl,78
xxxx:0108 mov ah,#5
xxxx:010A int 21
xxxx:010C mov dl,#1
xxxx:010E mov ah,#5
xxxx:0110 int 21
xxxx:0112 int 20
xxxx:0114 <enter a CR here>
-r cx
:14
-n nlq.com
-w
Writing 014 Bytes
-q
```

Figure 1: *This short program implements the codes for changing from draft to NLQ using the Epson LQ-1500 printer.*

100H. (The four-digit value to the left of the colon will depend on your machine's configuration.) Enter all the (lowercase) commands shown in Figure 1 exactly as you see them printed.

After the last assembler statement, enter a carriage return by itself, then set the CX register to the correct number of bytes, as shown in Figure 1. Use the N (for name) command to name the file NLQ.COM, and use the W (for write) command to write it to disk.

The program works by using DOS Interrupt 21H, Function 5H, to send printer control characters to the printer. Three calls to Interrupt 21H are needed, one for each byte in the control sequence (1BH, 78H, and 01H) required to enable near-letter quality on the LQ-1500.

After you have written the file, you can set your LQ-1500 into NLQ mode by just typing NLQ from the DOS prompt. A similar command could be written for a different printer by using different printer control codes.

Raj Shinghal
Aberdeen, South Dakota

MORE ON MODE CHANGES

The DOS MODE command lets you configure options for the asynchronous communications adapter, the display, and the printer. I often use it to set my printer with the condensed (132-column) format, but I always have to refer to the DOS manual to make sure I have all the MODE options entered correctly. It would also be nice if MODE had a way of setting my printer in normal (darkened) mode printing.

Since MODE doesn't offer these options and is a pain to use anyway, I wrote two short .COM programs that make using my printer much easier. The first program, called DARK.COM, sets the printer to the "enhanced" mode of printing. The other program, called SMALL.COM, sets up the printer to print in condensed mode.

You can enter the programs with DEBUG [*see general instructions above—Ed.*] as you see them in Figures 2 and 3. Then use them by just typing DARK or SMALL from the DOS prompt.

Gary D. Cochrell
Albuquerque, New Mexico

Power User readers submit tons of small printer-control .COM programs like those in Figures 1, 2, and 3, and each is very useful—for a particular situation.

One of my own favorites simply issues a

```
A>debug
-n dark.com
-a
xxxx:0100 mov dl,1b
xxxx:0102 mov ah,#5
xxxx:0104 int 21
xxxx:0106 mov dl,45
xxxx:0108 mov ah,#5
xxxx:010A int 21
xxxx:010C int 20
xxxx:010E
-r cx
CX 0000
:e
-w
Writing 000E bytes
-q
```

Figure 2: *A short program to invoke enhanced (dark) mode printing with Epson printers.*

■ POWER USER

```
A>debug
-
xxxx:0100 mov dl,0f
xxxx:0102 mov ah,05
xxxx:0104 int 21
xxxx:0106 int 20
xxxx:0108
-rcx
CX 0000
:8
-n small.com
-w
Writing 0008 bytes
-Q
```

Figure 3: This program will set Epson-compatible printers to condensed mode.

page feed to the printer. I like to see a fresh top of form sitting in the printer when a printout starts. Indeed, if you have a laser printer, such a program is mandatory to get screen dumps and other less-than-full-page outputs to come out of the printer. (If you want to make yourself a PAGE program, just change the 0f in the first line of the program in Figure 3 to a 0c, and use PAGE.COM in the N command.)

You must be careful in using or modifying such programs, however. Gary Cockrell's program for setting condensed print, for example, like the MODE command he replaced, works only with IBM– or Epson–compatible matrix printers. Most other printers use a 2- or 3-byte code for condensed printing, unlike the IBM/Epson design, which uses only one. As a result, a program for such printers would wind up looking more like Raj Shinghal's program for setting the Epson LQ-1500 to NLQ mode. Note that you would have to write an additional program incorporating the control codes to return to draft mode.

If your printer has a lot of options (and associated control codes) that you use less frequently, a more general program can be very useful. Such a program would accept the printer control codes as data and send them to the printer right from the DOS prompt. It turns out to be easier than you might think to create such a general-ized program; I have called this one PSET.

```
;PSET - Program to Send Printer Control Code Entered on
;         the Command Line to the Default Printer (LPT1:)
CSEG    segment para public 'code'
        assume cs:CSEG, ds:CSEG, ss:CSEG, es:NOTHING
        org 100h                    ;COM format
PSET
BEGIN:  mov     si,80h              ;Set SI to location of DOS parameters
        cld                         ;Set direction flag to forward
        lodsb                       ;Get byte count to AX
        mov     cl,al               ;Move it to CX
        dec     cx                  ;Decrement it to remove blank
        add     si,cx               ;Add to SI to point to end of string
        std                         ;Set direction flag to reverse
        mov     dx,1234h            ;Put up end-of-stack indicator
        call    MANAGER             ;Call stack & register manager
LOAD:   lodsb                       ;Get each character in parameter
        cmp     al,20h              ;Is this a blank?
        jne     HALT                ;Nope, go convert it to binary
        call    MANAGER             ;Call stack manager for each character
        loop    LOAD                ;Loop until blank reached
MULT:   sub     al,30h              ;Adjust for ASCII character into
        mov     bl,al               ;Multiply AL by BL
        mov     dl,al               ;Add AL to DL
        mov     al,bl               ;Set up to multiply BL by BL
        mov     cl,0Ah              ;(10 decimal) for next (left) char
        mul     bl                  ;Multiply AL by BL
LOOP:   mov     bl,al               ;Move result back to BL for next char
        pop     dx                  ;Loop back to get next character
        call    MANAGER             ;Call stack manager after last char
CLEAR:  pop     dx                  ;Pop character off stack
        cmp     dx,1234h            ;Is this the end of the stack?
        je      END                 ;Yes, end program
        mov     ah,05h              ;Set up for DOS printer call
        int     21h                 ;Call DOS
        jmp     CLEAR               ;Continue clearing stack
END:    int     20h                 ;Tes, end program
PSET    endp
MANAGER proc
        pop     bx                  ;Stack and register manager
        pop     cx                  ;Pop IP of stack into BX for a second
        push    dx                  ;Push the DX register onto stack
        push    bx                  ;Now push IP back on return is clean
        mov     bl,1                ;Store a 1 into BL for mult. right char
        pop     dx                  ;Pop character off stack
        ret                         ;Clear the DX register
        MANAGER endp                ;Return to caller
        CSEG    ends
        END     BEGIN
```

Figure 4: The assembly language source code for PSET.COM.

```
A>dxbug
-u
xxxx:0100 mov   ai,0000
xxxx:0103 cld
xxxx:0104 lodsb
xxxx:0105 cbw
xxxx:0106 xchg  cx,ax
xxxx:0108 mov   cx,ax
xxxx:010A add   xi,cx
xxxx:010C mov   dx,1234
xxxx:010F cald  #13:a
xxxx:0112 lodsb
xxxx:0113 cmp   al,20
xxxx:0115 jnz   811c
xxxx:0117 call  #13:a
xxxx:011A loop  8112
xxxx:011C sub   al,30
xxxx:011E mul   bl
xxxx:0120 add   bl,al
xxxx:0122 mov   al,bl
xxxx:0124 mov   bl,0a
xxxx:0126 mul   bl
xxxx:012A mov   bl,al
xxxx:012C cald  #112
xxxx:012F push  #13:a
xxxx:0130 pop   dx
xxxx:0132 mov   dx,1234
xxxx:0134 jz    #13c
xxxx:0136 mov   ah,05
xxxx:0138 int   21
xxxx:013A jmp   #12f
xxxx:013C int   20
xxxx:013E pop   dx
xxxx:013F push  dx
xxxx:0140 push  ax
xxxx:0141 mov   bl,41
xxxx:0143 xor   dx,dx
xxxx:0145 ret
xxxx:0146  <just enter a CR here>
- cx
:46
-n pset.com
-w
Writing #46 bytxs
-q
```

Figure 5: You can also create PSET.COM by entering this program in DEBUG.

PSET takes in the decimal ASCII codes as part of the command line and sends them to your printer. It's written in assembler (see the listing in Figure 4), and is small enough to enter using DEBUG (see Figure 5). Just in case you're not up to that, I've also supplied a BASIC program (Figure 6) that will create PSET.COM. All three versions are also available by modem 24 hours a day from PC Magazine's Interactive Reader Service at (212) 696-0360.

PSET is slightly more complex and somewhat larger than single-purpose printer control programs. Its job is to scan the command line, looking for numeric characters that represent decimal ASCII codes. (Be careful when you use it, since it does not check for non-numeric characters—if you enter them, you may get strange results on your printer.)

As PSET finds each code (separated by blanks), it converts it to binary (internal) representation and pushes it on the stack. When the scan is done, the codes are popped off the stack and sent to the printer using Function 5H of DOS Interrupt 21H (just as the other programs do). A value of 1234H is pushed onto the stack as the beginning of the program for use as an "end-of-stack" indicator. Since PSET scans from the end of the command line to the beginning, the control codes will be sent to the printer in the correct order when they are popped off the stack.

```
100 ' Program for creating PSET.COM
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR N% TO 5
130 FOR C%! TO 17
140 READ A%:IF C<17 THEN 160
150 S$=S$+VAL(A%)
160 NEXT:NEXT
170 IF S$<>9575 THEN RESTORE:GOTO 200
180 PRINT A%:PRINT: CHECK THE LAST NUMBER IN"
190 PRINT "EACH DATA STATEMENT--THEN REDO":END
200 FOR N%! TO 5
210 FOR C%! TO 16
220 READ A$:TT%=TT%+VAL("&H"+A$)
230 NEXT
240 READ N:IF B=TT% THEN 270
250 PRINT "DATA ERROR IN LINE";N%!*10+330
260 PRINT "CHECK FIGURES AND REDO":END
270 TT%=0:NEXT:RESTORE
280 OPEN "PSET.COM" AS #1 LEN=1:FIELD #1,1 AS D$
290 FOR N%! TO 5
300 FOR C%! TO 16
310 READ A$:LSET D$=CHR$(VAL("&H"+A$))
320 PUT #1:NEXT:PRINT DUNN#$:NEXT:CLOSE
330 PRINT "PSET.COM CREATED"
340 DATA BE, 00, BF, FC, AC, 98, 91, C8, 40, 5, 49, F1, FD, 3A, 34, 12, 88, 2291
350 DATA AC, 80, AC, 3C, 28, 75, 85, EB, CA, 80, 32, FB, 2C, 30, F6, E3, 1353
360 DATA 02, DB, BA, C3, B3, 0A, F6, E3, 8A, D8, E2, BB, E8, BF, 88, 5A, 2552
370 DATA 53, 8B, D4, BA, 34, 12, 74, 08, B4, 05, CD, 21, EB, F5, CD, 20, 1803
380 DATA 53, 83, 81, 33, 02, C3, 00, 00, 00, 00, 00, 00, 00, 00, 00, 26, 719
```

Figure 6: If you run this program in BASICA, it will automatically create PSET.COM for you.

■ POWER USER

You can create PSET.COM using the Macro Assembler, DOS LINK command, and EXE2BIN to convert PSET.EXE to PSET.COM. You can also enter it using DEBUG (Figure 5) or BASIC (Figure 6).

After you've created PSET.COM, the easiest test is to have it print a few ordinary characters (the program doesn't care that

■ MicroPro's instructions for installing *CorrectStar* on Version 3.3. of *WordStar* are straightforward enough, but if you're using DOS 3.x, they simply don't work.

they're not control codes) then issue a form feed to bring in a new page of paper. Try this, for example:

```
A>pset 00 07 32 77 97 107 87 122 145 118 16 12 LF
```

Once you've got this working, you can issue any printer control codes you want. You could, for example, replace Raj Shinghal's program with the following PSET command:

```
A>pset 27 12 β 1
```

If you find that you use the same PSET command frequently, you can either put it in a .BAT file and continue to use PSET, or you can make a .COM file of your own similar to the ones that are printed in Figures 1, 2, and 3.

—John Dickinson

CORRECTSTAR CORRECTION

MicroPro's instructions for installing *CorrectStar* on Version 3.3 of *WordStar* are straightforward enough, but if you're using DOS 3.x they simply don't work. All you get is an error message stating that *CorrectStar* can't find the internal dictionary. The following patch fixes the installation problem.

Put a disk containing DEBUG in drive A: and a copy of *CorrectStar* in drive B:. At the A: prompt, type

```
DEBUG B:CORRSTAR.OVR<Enter>
```

At DEBUG's hyphen prompt, enter the following lines:

```
E1242<Enter>
7C<Enter>
W<Enter>  (to write the change to disk)
Q<Enter>  (to quit DEBUG)
```

After this change, follow the rest of the installation instructions carefully, and *CorrectStar* will work like a charm.

Marc R. Schumer
Franklyn Park, New York

This patch works for CorrectStar 3.31 under both DOS 3.0 and DOS 3.1. But CorrectStar 3.30 needs a slightly different patch. With CorrectStar 3.30, begin as above. After typing 7C<Enter>, add two more lines. At the prompt, type

```
E3Ø <Enter>
9Ø <Enter>
```

Then conclude, as before, by typing W to write the change to disk, followed by Q to quit.—M.David Stone

POWERS AND LOGS

I was disappointed to learn that Turbo Pascal did not have a generalized exponentiation (that is, raise to a power) operator, so I wrote an exponentiation function using Turbo's exp and ln functions. Another useful function computes logarithms. Turbo offers the ln function, which handles only base e. The log function I wrote handles all positive bases.

Gary Later
Buellton, California

Gary Later's two functions are demonstrated in the short program shown in Figure 7. Although Turbo Pascal does not include all the math functions you may need, it generally does supply the core functions,

■ Turbo Pascal includes sin, cos, and arctan functions, but you can derive other trigonometric functions using well-known identities.

which can then be usefully combined as Mr. Later has done. For instance, Turbo Pascal includes sin, cos, and arctan functions, but you can derive other trigonometric functions using well-known identities.
—Charles Petzold

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```
Program PowerLog;

Var B, X : Real;
Function Power (B, X : Real) : Real;
  Begin Power := Exp (X * Ln (B)); End;
Function Log (B, X : Real) : Real;
  Begin Log := Ln (X) / Ln (B); End;
Begin
  WriteLn ('Test of Power function');
  Write ('Enter the base and exponent: ');
  ReadLn (B, X);
  WriteLn (B;8:3, ' raised to the power of ',
    X;8:3, ' = ', Power(B,X);8:3);
  WriteLn ('Test of Log function');
  Write ('Enter the base and argument: ');
  ReadLn (B,X);
  WriteLn ('Log base ', B;8:3, ' of ',
    X;8:3, ' = ', Log(B,X);8:3);
End.
```

Figure 7: *This demonstration program shows generalized power and log functions that use the built-in Turbo Pascal functions exp and ln.*

■ EDITED BY PAUL SOMERSON

USER-TO-USER

PC Magazine's readers share their favorite tricks for getting the most horsepower out of DOS, BASIC, and their systems in general.

INSTANT UPDATE

The technique in User-to-User, Volume 4 Number 21, for updating directories forces DOS to rewrite an entire file to disk. While this does work, it's more efficient to rewrite just the directory listing. My early model floppy-based PC took 34 seconds to update a 240K file using the older method.

I've created an assembler program called UPDATE.COM that will update the same 240K file in less than 3 seconds on the same system. UPDATE.COM searches for specific filenames, retrieves the system date and time, converts these to the format used by the DOS directory, and then writes the updated information back to the directory.

Create UPDATE.COM by running UPDATE.BAS in Figure 1. Then, to run the program, type UPDATE *filespec*, where *filespec* may include a valid drive and subdirectory path. However, UP-DATE.COM will not accept wildcard entries (such as ? or *).

If you wish to backdate or future-date a file, you can create a batch file called RE-DATE.BAT that contains the lines

```
echo off
date
time
update %1
```

Enter the date and time prompts accordingly. If your system has a clock, you can even end with an instruction to reset the clock to the proper date and time.

Peter Llewellyn
Cape Town, South Africa

While the program won't handle wild-cards, DOS will. If you want to update every file on your disk, for instance, simply create a short batch file called UPDTALL .BAT, based on the FOR subcommand, that contains the single line

```
FOR %%F IN (*.*) DO UPDATE %%F
```

What really gives this power is that you can substitute other ranges between the parentheses; for instance, a "(*.BAS)" will update all the BASIC files.

```
100 'UPDATE.BAS -- creates UPDATE.COM -- by Peter Llewellyn
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 17:FOR C=1 TO 17
130 READ A$:IF C<17 THEN 150
140 Z$=Z$+VAL(A$)
150 NEXT:NEXT
160 IF Z$<>26401 THEN RESTORE:GOTO 190
170 PRINT "Error:  Check the last number in"
180 PRINT "each DATA statement -- then redo":END
190 FOR B=1 TO 17:FOR C=1 TO 16
200 READ A$:TTL=TTL+VAL("&H"+A$)
210 NEXT
220 READ B$:IF VAL(B$)=TTL THEN 250
230 PRINT "DATA error in line "*B*18+300
240 PRINT "Check figures and redo":END
250 TTL=0:NEXT:RESTORE
260 OPEN "UPDATE.COM" AS #1 LEN=1:FIELD #1,1 AS D$
270 FOR B=1 TO 17:FOR C=1 TO 16
280 READ A$:LSET D$=CHR$(VAL("&H"+A$))
290 PUT #1:NEXT:READ DUMMY$:NEXT:CLOSE
300 PRINT "UPDATE.COM Created":END
310 DATA E8,53,90,8A,8D,4E,6F,20,41,72,67,75,6D,65,6E,74,1541
320 DATA 20,45,6E,74,65,72,65,64,0A,8D,52,65,2D,65,6E,74,1321
330 DATA 65,72,20,77,69,74,68,20,76,61,6C,69,64,20,66,69,2140
340 DATA 6C,65,73,70,65,63,0A,8D,2A,00,8D,41,72,67,75,6D,1226
350 DATA 65,6E,74,20,46,69,6C,65,20,6E,6F,74,20,46,6F,75,1474
360 DATA 6E,64,0A,8D,2A,8B,00,00,8F,B8,0A,0C,00,F9,00,1481
370 DATA 75,03,89,0F,00,46,0A,84,3C,21,74,27,3C,23,72,2E,1283
380 DATA 3C,29,76,1F,3C,2D,72,1E,3C,3A,76,17,3C,40,72,16,1810
390 DATA 3C,5A,76,0F,3C,5C,74,0B,3C,5B,72,0A,3C,7E,76,03,1147
400 DATA EB,04,90,00,85,47,FE,C9,00,F9,08,75,C8,C6,85,00,1947
410 DATA BA,00,00,F8,B9,21,00,88,08,4E,CD,21,3C,00,75,4E,1503
420 DATA 8A,2A,CD,21,8B,89,0C,07,88,C1,8L,04,0D3,E8,02,C6,2165
430 DATA 00,04,00,FE,C1,D3,E0,02,C2,08,04,00,50,BA,2C,CD,2267
440 DATA 21,8B,C1,8L,02,D2,E8,FE,C1,D3,E8,50,88,00,30,BA,2371
450 DATA 00,00,D2,21,00,C0,00,59,5A,80,01,57,CD,21,84,3E,CD,1985
460 DATA 21,8B,12,90,8A,83,01,86,09,CD,21,80,00,90,8A,39,1677
470 DATA 0A,80,03,CD,21,86,00,00,00,00,00,00,00,00,00,00,0000
```

Figure 1: *Program to create UPDATE.COM file time- and date-stamp updating program.*

■ USER-TO-USER

```
100 ' STAMP.BAS -- Auto Date-Time stamper -- by Bruce McDonough II
110 ' Last Run Date (dddddddddd)
120 ' Last Run Time (tttttttt)
130 GOSUB 140:END
140 DEF SEG=0
140 DEF SEG=(PEEK(&H30)+256*PEEK(&H31):L=10:A$=DATE$
150 IF PEEK(C)=123 AND PEEK(C+L+1)=125 THEN 160 ELSE C=C+1:GOTO 150
160 FOR I=1 TO L:POKE I+C,ASC(MID$(A$,I,1)):NEXT:C=C+12
170 IF L=10 THEN L=8:A$=TIME$:GOTO 150
180 SAVE "STAMP
190 RETURN
```

Figure 2: Program to date- and time-stamp BASIC programs automatically.

FREE STAMPS

The STAMP.BAS program in Figure 2 will automatically update the date and time in its own REM statements each time you run it and then write the new information to disk.

The program first looks for the beginning of the program in memory by peeking at addresses &h30 and &h31, then searches memory for the { } brackets. Once it's found them, it pokes the appropriate bytes of date and time into memory and saves the changed program.

Bruce McDonough II
Escondido, California

The subroutine in lines 140 through 190 can be put into any program to add the current date and time automatically. If you do this, be sure to insert an initial (dddddddddd) and (tttttt) near the beginning of the program. Afterward, each time you run the program the subroutine will log your use. The DOS directory listing will log the creation or change of a file, but not its normal running.

BEST BATCH BRANCH

I've noticed that very long batch files containing numerous IF . . . goto conditional statements tend to slow down dramatically as processing moves further along. DOS searches slowly for each new label from the top of the file, yielding a pathetic 5- to 10-second delay, even on an AT, if the label occurs near the end of a long batch. But I've discovered a way to get rid of all the labels and "IF errorlevel . . . goto" statements, allowing a batch file to work at top speed and still contain numerous conditional branches.

I can control most batches with a simple Y(es) or other single-key response to a batch request. Unfortunately, the GETKEYU technique described in an earlier User-to-

User sets a different errorlevel for every response. Because DOS returns a "true" if errorlevel <= the set value, batch files ordinarily require four "if errorlevel" tests to obtain "true" on Y or y but "false" on other keys.

The short GETYES.COM program in Figure 3 performs these tests, thereby removing them from the batch. It sets errorlevel 255 for Y or y and errorlevel 0 for any other key. This lets you directly perform an operation with the statement "if errorlevel 255 (perform some DOS function)."

I've also found that you can use "if" conditionals on one line of a batch file for further flexibility and control; for example, "if errorlevel 255 if exist filename (perform some DOS function)" or "if errorlevel 255 if x==%1 (perform some DOS function)". This doesn't seem to be documented in the DOS manual.

Robert J. Holmgren
New York, New York

```
A      MOV AH,00
       INT 16
       CMP AL,59
       JZ   018C
       CMP AL,79
       JNZ 018E
018C   MOV AL,FF
       MOV AH,4C
       INT 21

N GETYES.COM
       RCX
       12
       W
       Q
```

Figure 3: Script for creating GETYES.COM. *Type this program using the DOS COPY CON: command or a pure-ASCII word processor and name it SCRIPT. Be sure to include the blank line after INT 21, and hit the Enter key after each line, especially the last one. Then put DEBUG (Version 2.0 or later) on your disk and type DEBUG <SCRIPT.*

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■ **USER-TO-USER**

This technique makes batch branching a pleasure rather than a chore. You can create GETYES.COM by typing in the SCRIPT file in Figure 3 and then putting it on the same disk with any version of DEBUG 2.0 or later and typing DEBUG <SCRIPT. Or you can use the BASIC program in Figure 4.

If you want to use N and n rather than Y and y to trigger errorlevel, simply substitute 4E and 6E for 59 and 79, and change the reference from GETYES.COM to GETNO.COM. To test this after creating the GETYES.COM program, type in the

batch file (and name it TESTTHIS.BAT):

```
echo off
:start
echo hit y or n or another key
getyes
if errorlevel 255 goto :yea
goto :no
:yea
echo ...you said yea
goto :continue
:no
echo ...didn't hit y or Y
:continue
echo Now, want to quit (y/n)?
getyes
if errorlevel 255 goto :exit
goto :start
:exit
:exit
```

The nesting abilities described by Mr. Holmgren allow even more power. To test these, revise the fifth line of TESTTHIS .BAT to read

```
if errorlevel 255 if z=41 goto :yea
```

Then, if you execute TESTTHIS.BAT again, hitting Y or y at the first prompt will not result in a branch as it did earlier. To make both of the nested conditions true, instead of executing the batch file by typing TESTTHIS, at the DOS prompt type

```
TESTTHIS Z
```

and then hit Y or y when asked. The Z after the filename will replace the %1 parameter, and since both conditions (the errorlevel and the Z==Z) are true, the batch file will work as advertised. If you try this, be sure to type in a capital Z; DOS, which much of the time converts lower-case keyboard inputs into upper-case ones, is case-sensitive here.

```
100 ' GETYES.BAS -- creates GETYES.COM
110 OPEN "GETYES.COM" AS #1 LEN=1
120 FIELD #1,1 AS D$
130 FOR B=1 TO 18
140 READ A$:LSET D$=CHR$(VAL("&H"+A$))
150 PUT #1:NEXT:CLOSE
160 DATA B4,08,CD,16,3C,59,74,04,3C
170 DATA 79,75,02,B0,FF,B4,4C,CD,21
```

Figure 4: GETYES.BAS program for creating GETYES.COM.

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VOLUME PLEASE?

Although it's not documented, it's possible to change the volume label of a disk under DOS 2.1. The trick uses DEBUG to load the directory, changes the volume label, and writes the directory back.

First, load DEBUG (by typing DEBUG). Once you see the hyphen prompt, type

L 100 0 51

Then hit D to dump the contents, showing the label at &h160. Type the following line, where "labelname" is the new name you want (be sure to make this new name exactly 11 characters; if it's shorter, add spaces at the end to pad it out):

E 160 "labelname   "

Then, to write the revised directory back to the disk, type

W 100 0 51

Finally, hit Q to exit DEBUG.

Note: Using this method will also allow otherwise illegal characters such as a period or small letters.

Nathan Eide
Jackson, Michigan

Well, sort of. The instructions above are only for a floppy disk in drive A: that has just three files on it (presumably the two system files IBMBIO.COM and IBMDOS .COM, and COMMAND.COM) plus the volume label. A gutted version of the DEBUG dump of such a disk's directory would look something like this (ignore the xxxx at the beginning of each line)

```
xxxx:0100  IBMBIO  COM ........
xxxx:0110  ....`mg..\%..
xxxx:0120  IBMDOS  COM ........
xxxx:0130  .....4a....pl..
xxxx:0140  COMMAND COM .....
xxxx:0150  ......mg..{..
xxxx:0160  LABELNAME    {....
xxxx:0170  ..............
```

However, to your system, a volume label is simply one directory entry identified in a special way. DOS uses the 12th byte of the directory listing (actually byte 11, since the first byte is byte 0) to mark the file attribute(s). This byte will tell DOS whether a file is a hidden file, a system file, a read-only file, etc. It also identifies directory entries that are subdirectory names (by giving this byte a value of 10) or volume labels (by giving it a value of 8). And it lets DOS know whether the file was changed since the previous backup.

The value of the attribute byte for LA-BELNAME in the above example is 28, which means that it is a volume label and that the archive bit is set. However, LA-BELNAME doesn't have to be the fourth entry in the directory. It will be the fourth entry in the directory using the /S option (or if you format a fresh disk using the /S but then immediately use SYS to transfer the system files), and then immediately add a

■ USER-TO-USER

volume label. But the volume label could be anywhere on the directory.

If it is the fourth entry, you will indeed find it at address &h160. But if you don't have system files on your disk, the label could be at a lower address. And if you add the label after creating several files, the label could be at a higher address. To find it, after using the DEBUG L command to load the directory, use the D command to examine the twelfth bytes and look for a value of 8 or 28.

But be very, very careful. Note that DE-

■ The 12th byte will tell DOS whether a file is a hidden file, a system file, a read-only file, etc.

BUG refers to drive A: as drive 0, drive B: as drive 1, etc. So "L 100 0 5 6" would mean "load six sectors of drive A: starting with sector 5—all into memory starting at address 100." The W (write) command uses the same format. It's simple to type in an errant value and write a scrambled directory back to your disk. So if you try this, do it on a copy of a floppy disk only. And to be perfectly safe, don't ever write to a hard disk unless you're really sure of yourself and have a perfect backup copy handy.

And anyway, get with it. IBM and Microsoft keep revising DOS so you don't have to resort to such shenanigans. Recent versions of DOS supply you with a LABEL utility to do what you want. And while your method does allow you to put illegal characters in the volume name, DOS will probably be confused by it.

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PC TUTOR

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EXTRA MEMORY FOR BASIC

I am trying to develop a multipage screen-buffer technique for my monochrome display that will provide a function similar to the color adapter's ability to keep several different screen images stored in memory and flip them to the screen when appropriate. Using an assembler subroutine, I've been able to use the highest 12K when running with the BASIC interpreter. However, when the same program is run in compiled form (with appropriate changes such as CALL ABSOLUTE), my machine goes utterly berserk! It appears that I need to reserve a portion of memory. Is there a way to do this using the memory-management DOS function calls (48h, 49h, and 4Ah in DOS 2.1?

William C. Alston
Roswell, Georgia

Getting access to a chunk of memory to use within interpreted and compiled BASIC programs is a common problem.

Programs compiled under the old IBM and Microsoft BASIC compilers use all available memory from the beginning of the program upward. Since these compilers were designed to work under DOS 1.1, they do not free up any of this program memory using function call 44h. Consequently, a function call 48h from within an assembly language routine will not allocate a memory block since there is no memory left to allocate.

Nor could you first deallocate some of the compiled BASIC's memory with an assembler subroutine using function call 4Ah, because the program has already set

itself up in the memory and expects it all to be usable.

There are a couple of solutions to your problem, however.

Under the BASIC compiler you could define a string variable 4000 bytes long to hold the monochrome display contents with the following statement:

MONOHOLD$ = STRING$ (4000,0)

You could then use VARPTR to pass the address of this string to your assembly language subroutine. (Note that the first 2 bytes pointed to with VARPTR (MONO-HOLD$) contain the length of the string, which is 4000.) However, this would not work under the BASIC interpreter, whose strings are limited to 255 bytes.

If you'd like to keep the compiled and interpreted BASIC programs consistent in the way they store data in upper memory, therefore, you need to prevent the compiled BASIC program from taking up all of the

■ **Programs compiled under the old IBM and Microsoft BASIC compilers use all available memory from the start of the program upward.**

available memory. This can be done by modifying some of the header information in the compiled .EXE run file, though, as you'll see there may be some problems in this approach.

Every .EXE file begins with header information DOS needs to load the program into memory, perform segment fix-ups, and allocate space for it to run. This header information is documented in the DOS manuals for Versions 2.0 and earlier and in the DOS Technical Reference manuals for Versions 2.1 and later.

You can't see this header information if you load the .EXE file directly into DEBUG, because DEBUG uses the header to perform all the space allocation and fix-ups, making the program all ready to run. You'll have to first rename the file to an extension other than .EXE and then load it into DEBUG. (But then you won't be able to run it in DEBUG, so don't try.)
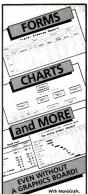
Use the following commands to look at the first part of an .EXE file header:

```
RENAME runfile.EXE runfile.XXX
DEBUG
-N runfile.XXX
-L 0
-D 0
```

The 2-byte word beginning at offset 000Ah is defined in the DOS Technical Reference manual as the "minimum number of 16-byte paragraphs required above the end of the loaded program." This word will often be at offset 0000h. The 2-byte word at offset 000Ch is the "maximum number of 16-byte paragraphs required above the end of the loaded program." This will usually be

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FFFFh, which means that the program wants all available memory above where it loads.

This extra memory space is used for the "heap" and the "stack." During calculations, for instance, the stack is used to store intermediate results. The heap is used by the program mostly for dynamic storage. If your program executes a STRINGS command such as I've shown above, or if it DIMensions an array, the result has to go somewhere. It goes in the heap. In a program that does a lot of dynamic string and array allocation, the heap can get pretty cluttered up and disorganized. At times, normal execution can grind to a halt while the program cleans up the heap in a process technically referred to as "garbage collection."

Of course, most compiled BASIC programs don't really need all available memory and can function normally with less. Thus, you can change the "maximum memory" word at offset 000Ch in the .EXE header to something lower than FFFFh to prevent DOS from allocating all available memory to the program.

Let's assume, for example, that you have 256K memory in your machine and that the bottom 128K memory is taken up by DOS and resident programs. (You get this second figure by subtracting the "bytes free" from the "bytes total memory" information provided by CHKDSK.) If your .EXE program is about 32K, you can give it another 64K when it runs and still have 32K left over at the top of memory for your screen swaps.

To do this, just enter the following DEBUG commands as a direct continuation of the program shown above (whose last line was -D 0):

```
-E 000C 00 10
-W
-Q
RENAME runfile.XXX runfile.EXE
```

Note that the 2 bytes (00 and 10) specified after the E (Enter) command are in reverse order, as usual. The actual word you've entered is 1000h or 4,096 decimal. This is the number of 16-byte paragraphs, and it corresponds to 64K bytes.

When you now run your .EXE program, the DOS loader uses this "maximum memory" word in the .EXE header

to compute a "top of memory" word (also in paragraph form) that it puts in offset 0002h of the program's Program Segment Prefix. The compiled BASIC prologue uses this value to limit the amount of memory it uses.

You can look at the Program Segment Prefix by loading the .EXE file (not the renamed XXX file) into DEBUG and executing the command

-D 0

If an .EXE header has FFFFh in offset 000Ch, the Program Segment Prefix top of memory word at 0002h will be 4000h for a 256K machine and A000h for a 640K machine (again, you'll see the 2 bytes shown

> ■ The .EXE file header contains a word "checksum" value, which is supposed to be used by the DOS loader to ensure .EXE file integrity.

in reverse order). If the amount of real available memory exceeds the length of the program plus the additional memory (plus the memory taken up by DEBUG), then you'll see a lower value. If you have enough high memory for screen swaps while in DEBUG, you'll certainly have enough when running the program outside of DEBUG.

How low can you set the value at 000Ch in the .EXE header? Definitely don't set it to 0—that indicates to DOS that the program is to be loaded high in memory, and it will crash. With some compiled BASIC programs on which I've experimented, I've set it as low as 0060h paragraphs (about 1.5K bytes). If you have a lot of dynamic string and array storage in your program, you'll need something higher, or you'll probably get an "out of memory" error during program execution.

Note also that the program may run slower, since it has to perform more fre-

quent garbage collections to clean up the heap. (This is not an abstruse concept for those of us who live in small apartments.) You'll probably have to experiment to get an optimum value.

If you do your compilation and linking using a batch file with a replaceable parameter for the filename, you can automate this .EXE header modification with the following batch file code after the LINK:

```
RENAME %1.EXE %1.XXX
DEBUG %1.XXX <HEADCHG
RENAME %1.XXX %2.EXE
```

where HEADCHG is a file containing the DEBUG commands

```
E 010C 00 10
W
Q
```

Note here that you have to use 0100h plus the header offset for the E (enter) command because DEBUG is loading the file at offset 0100h.

The .EXE file header also contains a word "checksum" value, which is supposed to be used by the DOS loader to ensure .EXE file integrity. If we change a value in the header, then the checksum will not check. However, DOS doesn't use this checksum when loading programs. If it does in the future, you'll have to make an adjustment to that value as well.

You may also be interested to learn that the LINK program included with the Microsoft (but not the IBM) Macro Assembler and the Microsoft C Compiler includes a switch called CPARMAXALLOC to set the maximum memory value during the LINK so you don't have to adjust it later. The new version of the Microsoft C Compiler also has an EXEMOD program to change this header information with a one-line command.

(People sick and tired of having COMMAND.COM reload after running a compiled BASIC program may alter this word to prevent the program from overwriting the transient part of COMMAND.COM at high memory.)

Although there's nothing wrong with modifying this part of the .EXE header, you may have problems using memory above the loaded program.

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First, the value you pick to go in the .EXE header will probably be dependent on your machine's memory configuration. If it's run on a machine with a few more resident programs loaded, you may not have enough high memory to store your screen swap.

Second, in a multitasking system such as TopView, this solution will be absolutely disastrous, because your program is using memory that doesn't belong to it. Only memory up to that top of memory word in the Program Segment Prefix is allocated for your program, and you are deliberately using memory higher than that. TopView may be using this memory for some other program. The same problem exists if you use high memory in the BASICA interpreter.

You also don't want to write over the first few bytes right after the top of the extra memory, because these contain a marker DOS uses for memory allocation.

Is there another solution? Yes, but it would require using a separate assembly language program to allocate memory below your loaded program. This assembly language program would perform the following four steps: (1) deallocate all memory above its code by executing the DOS 4Ah function call; (2) allocate a block of memory for screen swap (or BLOAD's or whatever) with function call 48h; (3) store the address of this block in lower memory, probably in one of the user interrupt vectors beginning at 0000:0180h; (4) load the compiled BASIC program (or the BASICA interpreter) using the EXEC function call 4Bh.

The BASIC program—in either interpreted or compiled form—could retrieve the address of the allocated memory block using PEEK and pass this address to the assembly language subroutine. When the BASIC program terminates, control would pass back to the assembler program that loaded it, which would then terminate.

If enough readers are interested in seeing such a program, perhaps I can cover it in a future PC Tutor column.

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REVIEWS IN BRIEF

Fast Text Editing: Point

BY VICTORIA DANOFF

Word processors aren't the only way to edit files. For some applications, they aren't even the best way. If you do more editing and copying of such text as programming code, for instance, than you do actual word processing, you need *Point*, a powerful mouse-driven text editor from Lemma Systems. By using a mouse, you can save a lot of editing time by pointing at commands rather than typing them or hitting specific keys.

Point requires either the Microsoft or the Mouse Systems mouse driver and mouse. All of *Point*'s power comes from this mouse interface. Typing-oriented users who have never used a mouse (myself included) will be amazed at how easy it is to move, copy, delete, search, change windows, and so forth, by pointing at text, windows, and commands. There's even a helpful mouse command chart in the manual that you can rely on until you get the hang of how to use the two mouse buttons for maximum power. Though I've become enamored of the mouse, it does take a while to become a mouse lover if you've been weaned on a keyboard as I was. *Point* obviously takes this "adjustment period" into consideration because you can also use the keyboard to execute all commands.

To access *Point*, you put the program disk into drive A: and type "pt filename" to get the file to come up with the program. You can type in up to 20 filenames (8 is the default), and they will all be called up to the screen with the program. You type /h, /v, /s, or /o after "pt" and before the filenames if you want the files to appear in horizontal, vertical, stepping, or overlapping windows instead of in full-screen mode. The program's manual and tutorial are useful for learning how to take advantage of all of *Point*'s features, though the wording may be a bit confusing to some at times.

Point couldn't possibly be more flexible. You can use it as it is or customize it to meet your editing requirements. You can edit up to 20 files (no length limit) in 20 windows, and with a click or two you can create a new window; zoom, stretch, or change the window size; or delete a window. If you don't like the list of commands in the top line on-screen, you can change the lineup. Or change the command names altogether. Most programs make you adapt to their ways, but you can make *Point* work your way.

Among the program's features are an undo option that lets you undo editing actions such as deleting or copying text, and a DOS Command Processor that allows you to get to the DOS prompt from within the program without quitting. *Point* also offers speedy shortcuts for experienced users, such as mouse-sensitive window parts and user-definable menus for frequently used commands.

Point's "undo last edit" option in the edit menu is quite amazing. Unbelievably, the manual boasts that *Point* can undo up to 200 edits with its "undo, erase history" option. I can't imagine ever wanting to undo that many changes, but I did try to undo 20 edits. It took awhile because I had to keep going back up to the edit menu, but it worked. *Point* undid everything I had done, restoring a file—one undo edit at a time—to its precedited version right before my eyes.

The program's color chart in the options menu is fun and easy to use. You use the mouse to point to a color square, and it appears instantly in the designated area. You can select a different background and text color for every part (border, command line, error messages, file text, and so on) of each of the 20 windows. If you want to use the same colors every time, you can put the codes into the program's installation file.

Point can be a powerful and flexible tool for programmers and others who edit multiple files and don't need word processing features. (By the way, you can edit text files originally created by any word processor, but the files will show all of your word processor's formatting codes, which are ignored by *Point*.) However, *Point*'s usefulness is based almost entirely upon a mouse. With a mouse, it's fast and useful. Without it, *Point* is just so-so.

IDEAssociates Diskit: Plug 'N Go Drive Kits

BY BILL MACHRONE

IDEAssociates' new Diskit add-in hard disk arrived at *PC Magazine*'s offices right in the middle of a crisis. Executive editor Paul Somerson was fuming because his PC AT had once again expired. He was trying to make do with a PC Portable and ranting about the uselessness of two floppy drives and no hard disk.

I opened the Diskit's packaging and found a 20-megabyte half-height drive and controller

Diskit hard drives are available in capacities of 10 to 120 megabytes.

inside. (Hey, IDE: You put the controller card uppermost in the foam packaging. Some clod is going to use it as a handle to get the drive out. Include unpacking directions right in the box.) Without further ceremony, we barged in on Paul, disassembled the PC Portable, ripped out the half-height 8: drive, and bolted the Diskit in place—cursing IBM all over again for its asinine combination of metric and U.S. screws in the Portable. No wonder it was a flop.

We got the Portable back together and booted up. A CHKDSK C: showed that the drive was already formatted and ready to go. We SYSed drive C:, copied COMMAND.COM over, reset, and watched as it booted from the Diskit drive. Then we read the directions.

The Diskit drives come in a variety of disk capacities (10 to 120 megabytes) and drive configurations (fixed or removable cartridge), with a controller card that can handle up to two drives. The 20-megabyte drive we installed (made by Seagate)

clocked in at 75 milliseconds on random seek, a respectable performance.

I started the installation at noon. Paul was smiling again by 1:30 p.m., and we'd spent half the time looking around for the right tools. Nice work, IDE.

Crystal 300 Power Conditioner: Clean, Forgettable Power

BY BILL MACHRONE

The best thing you can say about Curtis's Crystal 300 Power Conditioner is that it's utterly forgettable. Though we've tested it over the last several months, we have for the most part managed to remain blissfully unaware of its presence. The Crystal is a 300-watt power conditioner that adds a constant-voltage transformer (CVT) to the usual spike and noise protection. A CVT maintains a steady output voltage over a wide range of input voltages. The benefits of having

such a device were immediately noticeable on executive editor Paul Somerson's Enhanced Graphics Monitor, which had been plagued with constantly changing image size as voltages in our offices fluctuated from copiers, printers, and the like. With the Crystal in place, the image was rock-solid.

While the Crystal is not an uninterruptible power supply, it can bridge some brownouts that would look like interruptions to your computer. We had one such dropout a few weeks ago. Senior editor Bill Howard had the Crystal hooked up to his Compaq Deskpro. The lights flickered for an instant. A chorus of others raised from editors' offices as every machine reset except the Deskpro. Bill just smiled. (Since then, the Crystal has moved on to a more

askSam: Destructuring Your Database Files

BY BARBARA KRASNOFF

askSam, from Seaside Software, is one of a new genre of database management programs hitting the market. These new systems are based on the premise that users don't want the heavily structured formats that DBMS software has provided up to now. Instead of making you try to fit data into field-based records, askSam treats every screenful of data as a record. If you can type text onto a screen, you can put any kind of information in any order into any record and still be able to recall it when you need it. By including various tags and labels within the text, you can format, sort, select, and print the information later.

Of course, such flexibility has its corresponding price. Because it is such a text-oriented, free-form system, askSam does not offer the immediate ease of use of structured, menu-oriented systems. Though there is a help system, it is not at all context-sensitive, so you'll need to thumb through the accompanying manual quite a bit in the beginning. Also, since the program works on text, operations such as sorting may prove unbearably slow for large files.

Yet the unique formless format of askSam can lend itself to

more creative use of database information: You can adjust each record to your own formatting needs—from a fill-in data form to a screenful of extemporaneous text—in one file. For example, you can list keywords horizontally along each row of a screen in one record, with a structured data-entry form in the next. It doesn't matter to the program, which treats each record exactly the same.

Business database users with heavy data flow and organized data-entry operations will probably be happier with a more traditional and powerful product. But if you are not comfortable or satisfied with the usual structured DBMS, askSam is an interesting alternative.

genteel lifestyle in PC Labs, where it supplies a constant voltage for all the monitors under test to ensure consistent, repeatable measurements.)

Unlike most CVT-based conditioners, the Crystal sports a meter that indicates load. You won't need to refer to it often, but it's interesting to see the gross fluctuations in power as a computer warms up. If you're going to regulate the power to your PC and several peripherals, the meter also lets you know when you're about to exceed capacity.

In all, the Crystal 300 is forgettably memorable.

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